

ENVIRONMENT ASSESSMENT of Samson Resources Company's Proposed Field Development Program in and adjacent to the Hornbuckle Field, Converse County, Wyoming



Wyoming High Plains District District – Casper Field Office

August 2011



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ENVIRONMENTAL ASSESSMENT
of
SAMSON RESOURCES COMPANY'S
FIELD DEVELOPMENT PROGRAM IN AND
ADJACENT TO THE HORNBUCKLE FIELD
CONVERSE COUNTY, WYOMING

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1.0 INTRODUCTION

Samson Resources Company (SRC) has notified the Casper Field Office (CFO), Bureau of Land Management of their desire to further develop hydrocarbon resources within an area encompassing the existing Hornbuckle Field in Converse County, Wyoming - approximately twenty-six (26) miles northeast of the town of Glenrock in Townships 37 and 38 North, Range 73 West (see Figures 1.1 and 1.2). The project proposal includes the drilling of up to 96 additional wells within and/or adjacent to the Hornbuckle Field using horizontal drilling techniques - with these 96 wells to be drilled from a maximum 48 new well pads. The project proposal would also include the installation of the necessary equipment to facilitate the production thereof should they prove to be commercially productive.

This environmental assessment (EA) has been prepared to analyze the potential impacts that could result from implementation of the Proposed Action or alternatives thereto. The EA assists the Bureau of Land Management in project planning, ensuring compliance with the *National Environmental Policy Act* of 1969 (NEPA), and in making a determination as to whether any “significant” impacts could result from the analyzed actions. “Significance” is defined by NEPA and is found in 40 CFR 1508.27. This EA will assist the Authorized Officer (AO) in making a determination to either issue a Finding of No Significant Impact (FONSI) or begin the preparation of an environmental impact statement (EIS). A FONSI is a document that briefly presents the reasons why implementation of the Proposed Action would not result in significant environmental impacts (effects) beyond those already addressed in the Casper Resource Management Plan and Record of Decision (BLM 2007). If the Authorized Officer determines that this project has significant impacts following the analysis in this EA, then an EIS would be prepared for the project. Otherwise, a Decision Record (DR) may be signed for the EA approving the selected alternative.

The project proposal would involve the drilling of up to 96 new oil/gas wells over a period of approximately three to four years. Approximately ninety (90) percent of these wells would be drilled utilizing horizontal drilling technology to maximize the potential of the Sussex Formation (Fm) for commercial oil production at vertical depths of approximately 10,200 feet. The remaining ten (10) percent of these proposed wells may be exploratory in nature to determine the potential for commercial production from the Sussex Fm at locations removed from the current boundaries of the Hornbuckle Field or to test deeper formations within the overall project area. Information gathered from the drilling and evaluation of these exploratory wells would ultimately be used to determine if additional opportunities exist within the area for oil/gas production.

Oil will remain an integral part of the energy future of the United States until such time as reasonably-priced alternative energy sources have been developed and become readily available. By continuing to develop domestic hydrocarbon reserves, the United States would reduce dependence on foreign sources of energy and maintain an adequate and stable supply of fuel to maintain economic well-being, industrial production, and national security.

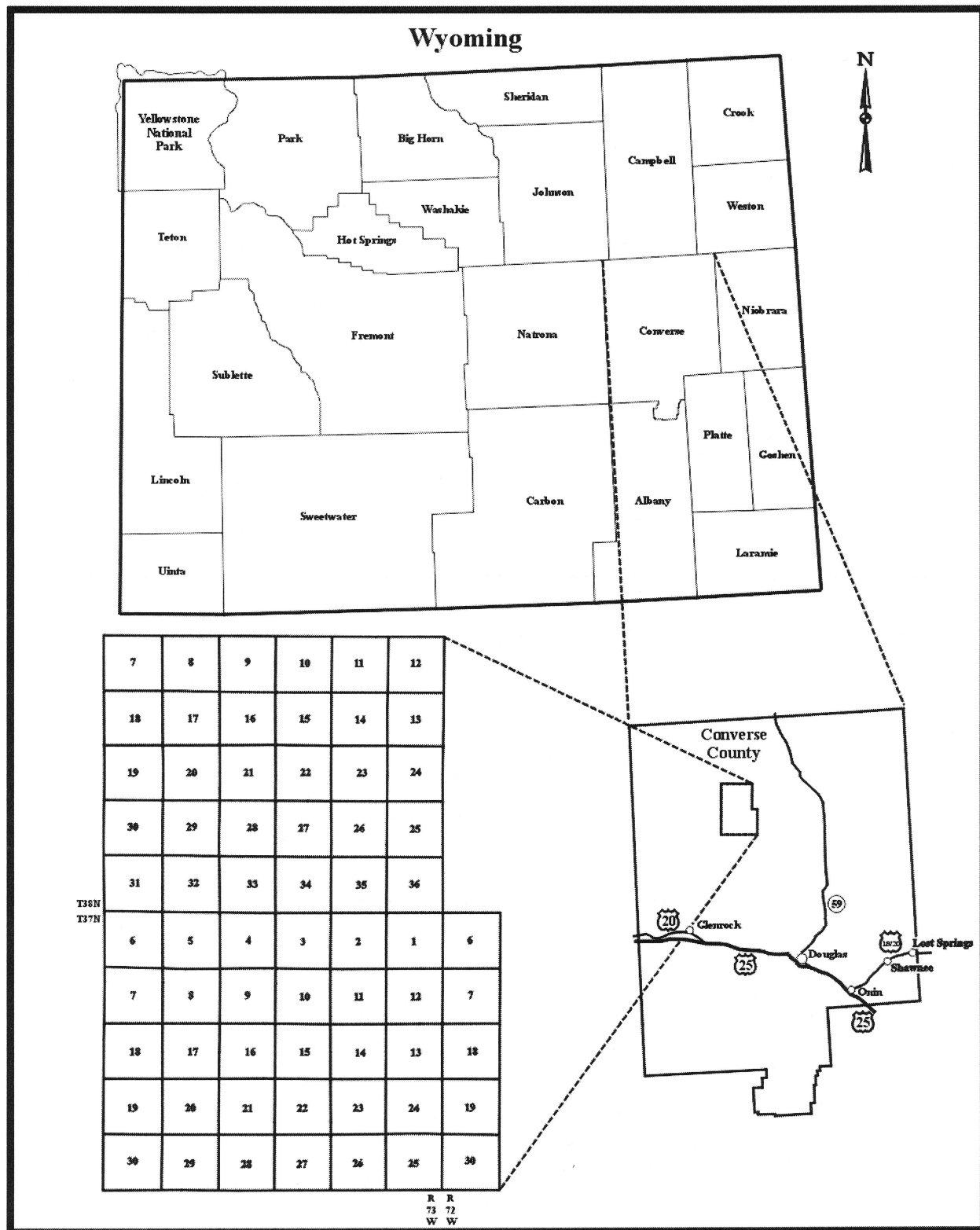


Figure 1.1: General Project Location

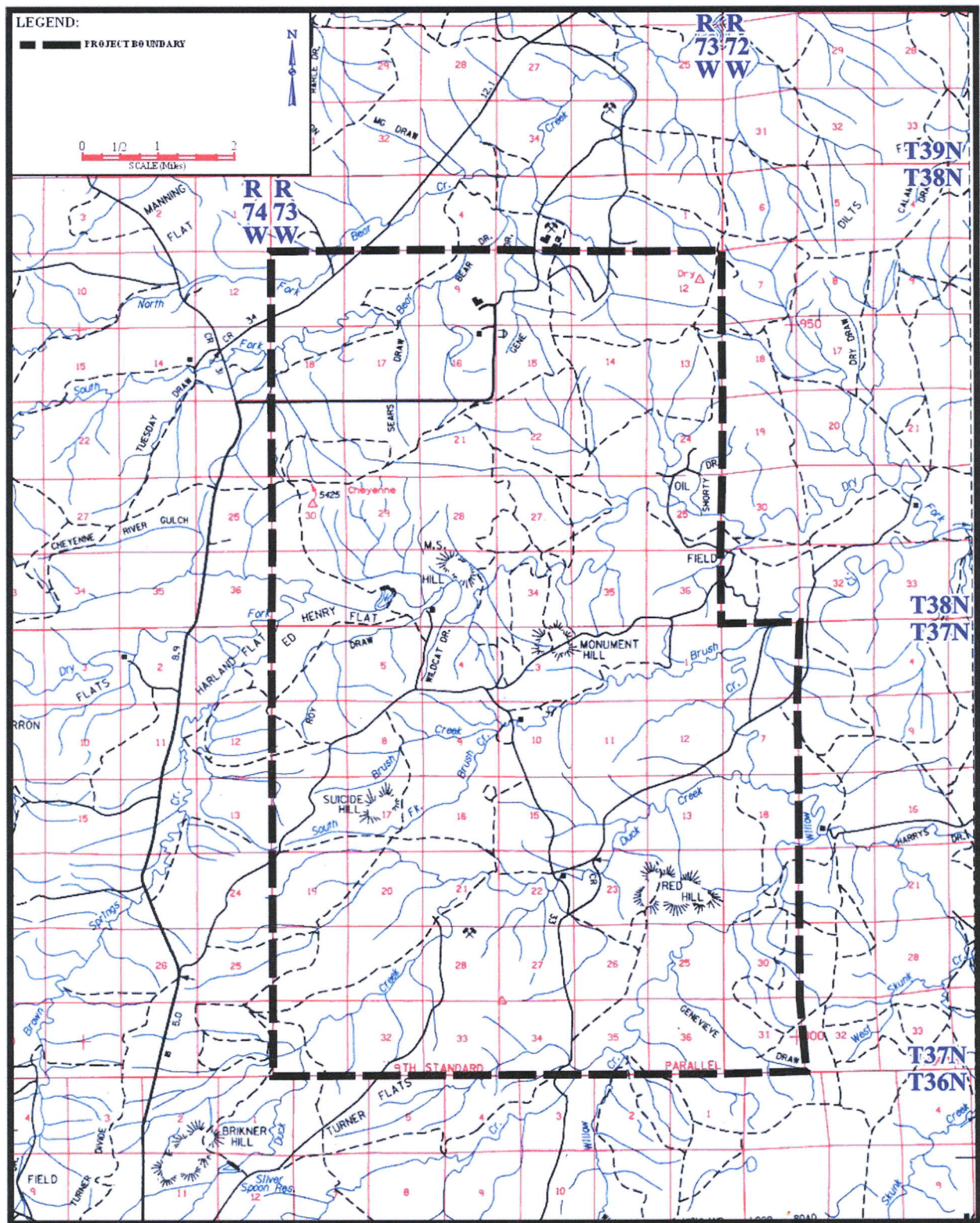


Figure 1.2: General Project Vicinity Map

1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1.1 Need for the Proposed Action

The need for the proposed project is to satisfy the operator requirements listed in 43 Code of Federal Regulations (CFR) 3162.3-1 (drilling applications and plans).

1.1.2 Purpose of the Proposed Action

The purpose for additional exploration and development activity with the proposed project area is to help meet the growing energy demands of the United States through the development of oil and gas leases and maintain production of oil and gas reserves owned by the United States, thereby reducing national dependence upon foreign energy supplies, as established by the BLM's responsibility under the authorities of the *Mineral Leasing Act* (MLA) of 1920 as amended (30 USC 181 et seq.), the *Federal Land Policy and Management Act* (FLPMA) of 1976 (43 USC 1701 et seq.), the *Federal Onshore Oil and Gas Royalty Management Act* (FOOGRMA) of 1982 (30 USC 1701 et seq.), and the *Federal Onshore Oil and Gas Leasing Reform Act* (FOOGLRA) of 1987 (30 USC 226 et seq.). Specifically, to promote the development of oil and gas on the public domain, and that those deposits of oil and gas owned by the United States shall be subject to disposition in the form and manner provided by the MLA under the rules and regulations prescribed by the Secretary of the Interior, where applicable through the land use planning process.

1.1.3 Decision to be Made

The BLM will decide whether or not to authorize the proposed exploration and development activities as described within Chapter Two and, if so, under what terms and conditions.

1.2 GENERAL LOCATION AND LAND OWNERSHIP

The overall project area encompasses approximately 46,080 acres (72 sections) of mixed federal, state and fee (private) lands (based on a standard 640 acre section). Of this total, approximately 5,375 acres are owned by the United States, 6,000 acres are owned by the State of Wyoming, and the remaining 34,705 acres are owned by private individuals. Table 1.1 summarizes surface ownership within the overall project area. Table 1.2 summarizes the mineral ownership therein.

A complex mixture of ownerships is present in two areas associated with old uranium mining facilities. At the Spook Site, 80 acres of federal mineral estate located in portions of sections 27 and 28 in Township 38 North, Range 73 West were withdrawn and permanently transferred to the Department of Energy (DOE) under Public Land Order (PLO) 6811, dated October 19, 1990. The withdrawal segregated the federal mineral estate from operation of the public land laws, including the mining and mineral leasing laws, subject to valid existing rights on the effective

date of the withdrawal order. As a valid existing right on the effective date of the withdrawal, oil and gas lease WYW-76347 was not transferred to DOE, but continues to be administered by the Secretary of the Interior through BLM. This lease includes 30 acres of Federal mineral estate within the 80 acre Spook Site. The lease is currently held by production (HBP). At such time as the lease terminates, the valid existing right will be extinguished and full jurisdiction over the Spook Site will rest with DOE. Oil and gas lease WYW-164687 was issued on November 15, 2005, after the effective date of the withdrawal order. Since the lands were segregated from oil and gas leasing under PLO 6811, the lease should not have been issued and efforts are being made to cancel it.

Table 1.1

**Surface Ownership within the SRC Hornbuckle
Field Development Project Area**

Surface Ownership	Acres	Percent of Total
Federal - Administered by BLM	3,755	8.14
Federal - Administered by the USFS	1,620	3.53
Federal - Administered by the DOE	80	0.17
State of Wyoming (State)	6,000	13.02
Private (Fee)	34,625	75.14
TOTAL	46,080	100.00

The Bear Creek mine includes 25 acres of Federal surface and mineral estate located in Section 9 of Township 38 North, Range 73 West and this surface/mineral estate is proposed for withdrawal similar to the Spook Site. The federal surface estate is within the Thunder Basin National Grassland and is administered by the Forest Service under the Department of Agriculture. The federal mineral estate underlying this property is administered by BLM. The land was segregated under proposed withdrawal WYW-164607 from operation of the public land laws including the mining and mineral leasing laws for a two year period effective April 4, 2008. The property is currently subject to oil and gas lease WYW-57343, which is also HBP. This federal oil and gas lease includes not only the 25 acres mentioned above, but also the remainder of Section 9 excluding the NW¼.

Of the 5,375 acres of federal surface estate situated within the overall project area (excluding the 80 acres associated with the Spook site), 3,755 acres are administered by the Casper Field Office, Bureau of Land Management with the remaining 1,620 acres included within the Thunder Basin National Grassland. These federal lands are administered by the Douglas Ranger District, U.S. Forest Service (USFS). To the greatest extent possible, SRC will attempt to avoid any project-related (surface disturbing) activities on those lands subject to the administration of the USFS.

Table 1.2

**Mineral Ownership within the SRC Hornbuckle
Field Development Project Area**

Mineral Ownership	Acres	Percent of Total
Federal	29,760	64.58
State of Wyoming (State)	6,000	13.02
Private (Fee)	10,320	22.40
TOTAL	46,080	100.00

As a consequence, this analysis document does not consider the impacts of oil/gas exploration and/or development activities associated with the Proposed Action on USFS lands. Should SRC ultimately propose any surface disturbing activities on surface estate subject to USFS jurisdiction, additional analyses would be required prior to the approval thereof.

Likewise, considering the current status of the lands/minerals contained within the Spook and Bear River sites referenced above, SRC has no plans to pursue any exploration or development activities on those lands/minerals subject to DOE management authority.

1.3 CONFORMANCE WITH EXISTING LAND USE PLANS

BLM planning for the project area is documented in the Casper Resource Management Plan (CRMP) approved in December of 2007 (BLM 2007). The CRMP established the following objectives for oil and gas resources:

- MR:2.1 Maintain oil and gas leasing, exploration, and development, while minimizing impacts to other resource values.
- MR:2.4 Facilitate the evaluation of public lands for oil and gas potential.
- MR:3.1 Maintain opportunities to explore and develop federal oil and gas resources and other leasable minerals.

The CRMP specified the following decisions/management actions to achieve the above objectives:

- Decision 2004 (Leasable Minerals) - The Casper Field Office is open to mineral leasing, including solid leasables and geothermal, unless specifically identified as administratively unavailable for the life of the plan for mineral leasing. These open areas will be managed on a case-by-case basis.

- Appendix D - Oil and Gas Operations, Applications for Permit to Drill (APD) specified “If necessary, site-specific mitigation can be added to the APD as a Condition of Approval (COA) for protection of surface and/or subsurface resource values in the vicinity of the proposed activity”.

In accordance with 43 CFR 1610.5-3(a), the Proposed Action has been determined to be in conformance with this plan. The project area has been determined to be suitable for oil and gas leasing and the proposed exploration and development with incorporated mitigation measures to reduce impacts to other resource values is consistent with the land use decisions and resource management goals and objectives.

1.4 RELATIONSHIP TO STATUTES, REGULATIONS, AND OTHER PLANS

This EA has been prepared in accordance with NEPA and is in compliance with all applicable regulations and laws passed subsequent thereto, including the Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508), U.S. Department of the Interior (USDI) requirements contained in *Department Manual 516, Environmental Quality* (USDI 1980), guidelines listed in the *BLM Manual Handbook, H-1790-1* (BLM 1988), and *Guidelines for Assessing and Documenting Cumulative Impacts* (BLM 1994). The proposed project would be consistent with other federal, state and local laws, rules and regulations and SRC would procure any required permits or easements prior to the commencement of drilling operations and subsequent evaluation of the 96 proposed wells as identified in Table 1.3.

Table 1.3

Major Federal, State and Local Permits and Approvals Required for the SRC Hornbuckle Field Development Project Proposal

Agency	Permit, Approval or Action
Bureau of Land Management	Approval of the individual Applications for Permit to Drill (APDs) for operations on federally-owned mineral estate
U.S. Forest Service (USFS)	Approval of Surface Use Plans accompanying individual APDs for operations on federal surface estate within the Thunder Basin National Grassland
U.S. Fish and Wildlife Service	Conformance with the Endangered Species Act
Wyoming Game and Fish Department	Coordination on impacts to wildlife and state-sensitive species
Wyoming State Engineer	Approval of permit to appropriate ground/surface water for use in drilling operations
Wyoming Oil and Gas Conservation Commission	Approval of the individual State of Wyoming drilling permit applications
Affected Private Surface Owners	Easements/agreements for surface disturbing operations on privately-owned surface estate

2.0 PROPOSED ACTION AND ALTERNATIVES

This environmental document analyzes the impacts of the Proposed Action and the No Action Alternative for the construction of approximately 48 additional well pads within and adjacent to the Hornbuckle Field in northern Converse County. These well pads would be designed to accommodate drilling and completion operations on two (2) wells per pad resulting in a maximum of 96 additional wells drilled within the overall project area.

As stated in Section 1.1.1, SRC expects that up to ten (10) percent of these proposed wells would be exploratory in nature to determine the potential for commercial production from the Sussex Fm at locations removed from the current boundaries of the Hornbuckle Field or to test deeper formations within the overall project area.

All of these wells would be drilled by SRC on or into federally-owned mineral estate within the overall project area in an attempt to 1) expand commercial oil production from the Sussex Formation (Fm) within the Hornbuckle Field, and 2) to test the productive potential of other geologic formations within the overall project area including the Parkman Fm, which is productive in the Dry Fork Field located in the extreme northeast corner of the project area.

The only other alternative considered available or reasonable in this analysis is the No Action Alternative.

2.1 THE PROPOSED ACTION

SRC is proposing to construct approximately 48 additional wells pads within the Hornbuckle Field and adjacent areas in order to develop existing oil reserves within the Sussex Fm as well as determine the potential for commercial oil/gas production from other geologic formations within the overall project area. The project proposal would involve the drilling of a combination of both horizontal and vertical wells within the overall project area to develop and explore the federal mineral estate as defined above. Specific surface locations for all of these wells have not been selected at this point but would generally consist of one horizontal well per section and would comply with well spacing requirements as prescribed by the Wyoming Oil and Gas Conservation Commission (WOGCC) for horizontal wells. Vertical well spacing is also governed by the State of Wyoming, which currently allows well densities of up to 16 wells per section (40 acre spacing) for those geologic formations above the Frontier Fm (above 11,000 feet) and one well per section (640 acre spacing) for those wells targeting the Frontier, Muddy and/or Dakota formations below 11,000 feet.

Special spacing rules and regulations have been implemented by the WOGCC for the vertical development of the Sussex Fm within the Hornbuckle Field that allows for four wells per section (160 acre spacing) and any vertical wells drilled within the field would be subject to these spacing requirements. Outside of the Hornbuckle Field, the well spacing reverts to the statewide 40 acre spacing pattern for vertical oil wells, and SRC would have the option of utilizing the existing statewide spacing pattern for exploratory wells, drilling additional wells on an expanded spacing

pattern (i.e., 160 acres) and/or could file an application with the WOGCC to revise the spacing as deemed appropriate from a reservoir engineering standpoint.

Drilling operations would be initiated as soon as all of the necessary permits have been obtained (subject to any timing restrictions for the protection of wildlife on specific drilling permits). It is anticipated that these wells would be drilled over a period of two to four years based on a combination of drilling success, rig availability and market conditions.

As stated above, the individual well pads would be designed to accommodate the drilling of a second well from each pad and the timing of operations on the second well would be contingent upon several factors, particularly during the early stages of the project as follows:

1. production rates and subsequent reservoir analyses on the initial well, and
2. lease issues including:
 - a) lease expiration dates, and
 - b) correlative rights where multiple leases are penetrated by a single well bore.

As wells are drilled within the field and additional reservoir data is gathered, we expect that SRC would ultimately be able to drill both wells with the same drilling rig back-to-back. However, until such time as SRC has acquired sufficient reservoir information to determine the most efficient way to recover oil/gas reserves in the Sussex Fm to allow for that contingency, we would expect a six to twelve month delay between the drilling of the first and second wells.

Considering that each well pad will be specifically designed for a second well, the drilling thereof would not require any additional surface disturbance prior to the commencement of drilling operations. In most cases the second well bore would be located approximately forty (40) feet from the existing (initial) well bore (see Appendix A).

Production facilities for multiple wells would be consolidated to the greatest extent possible. Pursuant to both BLM and WOGCC rules and regulations, production from wells within a common lease or spacing unit either permitted or prescribed by governmental authority under an approved Communitization Agreement (production unit) may be commingled. However, wells located on a common pad which produce from different production units or leases would be measured separately for royalty accounting purposes and the production from each well bore located on a common pad but developing a separate production unit or lease must be processed and stored separately from one another.

All lease operations would be conducted in full compliance with all applicable laws, regulations (43 CFR 3100 et al.), *Onshore Oil and Gas Orders*, the approved plan of operations and any applicable Notices to Lessees. Operations on federal lands would be conducted in compliance with 43 CFR 2800 et al.

2.1.1 Construction Activities

Construction activities for each proposed well location and access road route would follow practices and procedures outlined in each individual Application for Permit to Drill (APD) and any Conditions of Approval (COAs) appended thereto by the BLM. Access road and well pad construction activities would follow guidelines and standards as set forth in the joint BLM/U.S. Forest Service (USFS) publication: *Surface Operating Standards for Oil and Gas Exploration and Development* (Fourth Edition) and/or the contractual requirements of any affected private (fee) surface owner(s).

2.1.1.1 Access Roads

Access to the project area would generally be obtained via the Ross Road (Converse County Road #31) and then via existing, upgraded oilfield roads (crowned and ditched with gravel running surfaces) to the extent possible within the field. The amount of road proposed for construction/reconstruction in conjunction with the eight horizontal wells previously analyzed in 2009 (BLM 2009) averaged 1,450 feet per well (construction of 825 feet of new road and the reconstruction of 625 feet of existing two-track trail). Based on the preliminary surveying work conducted so far in conjunction with this project proposal, this number will be revised upwards to approximately 2,477 feet of new access road per well location (based on 18 new well pads staked within the project area to date).

Using this average, access to the forty-eight well locations proposed herein would require the construction/reconstruction of approximately 118,896 feet (22.52 miles) of access road, resulting in the initial disturbance of an additional 109.18 acres of surface estate (based on a maximum disturbed road width of 40 feet) or approximately 2.28 acres per well location.

Access across any off-lease federal lands crossed in conjunction with oil/gas activities proposed in conjunction with the proposed action would require the approval of a separate right-of-way (ROW) application by the Authorized Officer, Bureau of Land Management (BLM).

Whenever possible, access roads would be designed and constructed to disturb less than the 40 foot right-of-way (ROW) width referenced above so long as traffic and safety concerns could be satisfied. The existing access roads would be maintained as necessary to accommodate appropriate year-round traffic and prevent unnecessary erosion. Roads would be constructed in accordance with BLM manual section 9113 and/or the roading standards outlined in the joint BLM/USFS publication: *Surface Operating Standards for Oil and Gas Exploration and Development* (Fourth Edition) and would be designed by a professional engineer as necessary or where required by the BLM.

Topsoil would be stripped from the access road corridor as directed by the affected fee surface owner(s) and/or BLM prior to the commencement of construction activities, with the stockpiled topsoil redistributed on the “outslope” areas of the borrow ditch following completion of road construction activities. These borrow ditch areas would then be reseeded as soon as practical thereafter with a seed mixture to be recommended by either the private surface owner or the BLM.

In the event that commercial production is established from any/all of the proposed wells, the access roads would be graveled with a minimum of four inches of gravel as necessary or required by either the private surface owner or the BLM and the roadway would remain in place for the productive life of the well(s). This gravel would be most likely be obtained from the Knife River Quarry located in Sections 13, 23, 24 and 26 in Township 33 North, Range 76 West in Converse County, Wyoming, or through other commercial gravel suppliers in the area to be identified at the time of APD submittal. As the gravel would be obtained from pre-existing, permitted sources within Converse County, we do not anticipate the need to construct any new roads in conjunction gravel transport. Haul roads that cross any off-lease federal lands would require an approved ROW application from the BLM AO prior to the use thereof.

2.1.1.2 Well Locations

Major components of the proposed well pad would include:

- a leveled area suitable for placement/support of the drilling rig and related equipment; and
- a series of three earthen reserve pit(s) designed to contain the drilled cuttings and/or fluids to be used during the completion operation.

Construction activities for each well would follow practices and procedures outlined in each individual APD and any Conditions of Approval (COAs) appended thereto by the BLM. Well pad construction activities would follow guidelines and standards as set forth in the joint BLM/U.S. Forest Service (USFS) publication: *Surface Operating Standards for Oil and Gas Exploration and Development* (Fourth Edition). Sufficient topsoil to facilitate revegetation would be segregated from subsoil materials during construction and stockpiled for future reclamation of the disturbed areas. The salvaged topsoil would be evenly distributed over those disturbed surfaces subject to reclamation upon termination of drilling and completion operations as part of the reclamation and revegetation program. Topsoil stockpiles would be stabilized with vegetation until used for reclamation purposes as necessary or required by either the private surface owner or the BLM.

After the topsoil has been removed, the well pad would be graded to produce a level working platform around the drill hole(s) for support of the rig substructure. The excavated soil material (subsoil) would be utilized in overall pad construction, with the finished well pad graded to allow for positive drainage of natural water (e.g., rain and/or snow melt) away from the drill site.

The level area of the well pad required for drilling and completion operations (including the fresh water reservoir used for completions) would be approximately 530' x 354' (4.31 acres) in overall size (see Appendix A). Minor deviations would occur in the overall size of individual well locations due to topographic constraints and efforts by BLM, SRC and the private surface owners to limit surface disturbances in certain circumstances (including, but not limited to, areas of extensive cuts and/or fills, proximity to ephemeral drainages, etc.) as determined at the time of the on-site inspections.

In addition to the surface disturbance associated with the level pad area, an additional 0.5 acres of surface disturbance would result from the cut/fill slopes associated with pad construction and an additional 1.12 acres of surface disturbance associated with topsoil/subsoil storage adjacent thereto (based on average surface disturbances associated with the 18 new well pads staked within the project area to date). Construction of all forty-eight well locations would result in approximately 284.64 acres of additional surface disturbance within the overall project area (average total of 5.93 acres/well pad).

Erosion control would be maintained through prompt revegetation and by constructing surface water drainage control structures such as berms, diversion ditches and waterbars as necessary on the proposed well location(s).

Prior to the commencement of drilling operations, SRC intends to fence each individual well location on all four sides in order to protect both wildlife and livestock. This fencing would be installed in accordance with guidelines contained in the joint BLM/USFS publication: *Surface Operating Standards for Oil and Gas Exploration and Development*, Fourth Edition and would be maintained until such time as the well(s) have been plugged and abandoned and the well location successfully reclaimed. Cattleguards or cattleguards with gates would be installed in the perimeter fence(s) in accordance with the wishes of the surface owner and/or BLM.

2.1.2 Drilling Operations

To facilitate the drilling of the proposed wells, SRC would utilize a rotary drilling rig capable of drilling to the depths necessary for each individual well. Rig transport and on-site assembly would be completed in approximately seven days per well and actual drilling operations would require approximately thirty-five days/well to reach the proposed target depth. The proposed drilling operation would not penetrate any formation(s) known or suspected to contain concentrations of hydrogen sulfide (H₂S) gas.

SRC has no plans to install a man camp within the overall project area to house drilling personnel at this time. Self-contained trailers would be utilized on the individual well locations to house key personnel including the drilling crews during the drilling operation; however, these trailers would be temporary in nature and would be removed following the termination of drilling and completion operations on each individual well.

Service technicians, salesmen and drilling consultants would commute to the project site daily, most likely from either the Casper or Douglas areas.

Human waste and gray water generated during operations would be collected in either standard portable chemical toilets or portable service containers located on-site and would be transported off-site to a state-approved wastewater treatment facility upon completion of operations. Non-human waste would be collected in enclosed containers and disposed of in a state-approved solid waste disposal facility.

2.1.2.1 Drilling Fluids System

SRC intends to utilize a “semi-closed” mud system for solids and liquids control during the drilling operation. During drilling operations, a combination of shale shakers, mud cleaners and centrifuges (if necessary) would be used to segregate the drilled cuttings from the drilling fluids. The fluids would be returned to the mud tanks for continued use in the drilling operation and the segregated (semi-dry) cuttings would dump directly from the separation equipment into an open top steel mixing tank for solidification prior to temporary storage and ultimate disposal. Use of a “semi-closed” mud system would allow SRC to manage/minimize fluid use while maintaining pressure control and hole integrity during the drilling operation.

The actual drilling operation would utilize a fresh-water based mud system with additives to drill the surface hole (surface to approximately 2,000'). Basically, this system involves drilling with water and utilizing non-hazardous additives such as bentonite to stabilize the hole and minimize down hole sloughing. On the average, SRC would utilize approximately 1.27 barrels of water (42 gallons/barrel) per foot of hole drilled (or approximately 107,000 gallons) to drill the initial 2,000 feet of hole on each well, with this water obtained from an approved source in the immediate project area. The specific source of this fresh water used in drilling operations for each well would be identified at the time of APD submittal. Appropriate ROWs would be obtained as needed for access across any off-lease federal lands. Upon completion of drilling operations on the surface hole, any water remaining in the mud tanks would be used in future drilling operations on subsequent wells or trucked to an approved disposal facility as appropriate.

SRC intends to utilize temporary above-ground polyethylene lines (fast lines) to supply water from the water source(s) to the frac pit on location where possible. These “fast lines” would be approximately two (2) to three (3) inches in diameter and would be spooled on a small trailer for distribution. In most cases, the trailer with the spooled line would be pulled by an all-terrain vehicle (ATV) and distributed along the proposed line route. In some cases, the line may already be in place from previous use and would just be realigned using an ATV. These “fast lines” would typically be laid in the borrow ditch along the existing access road in most cases; however, cross-country routes may be necessary in some cases due to topography and other factors encountered in the field. Typical line lengths are expected to be somewhere between 4,500 feet to 7,500 feet, depending on the distance from the water source to the point of use and would be in place for no more than two (2) months. Upon completion of operations, the “fast lines” would be removed (picked up) in the same manner as they were laid - respooling the line using the ATV and trailer. Only minimal surface disturbance would be associated with the installation and/or removal of these temporary surface lines. Appropriate ROWs would be obtained for those fast lines crossing off-lease federal lands.

Upon setting and cementing of the surface casing string, SRC would switch to an oil invert mud system (approximately 80% diesel fuel and 20% water) to drill the remainder of the hole, with approximately 150,000 gallons of diesel fuel and 38,000 gallons of water used in the invert mud system. Use of an oil-invert mud system would reduce the potential for hole sloughing while drilling through water-sensitive formations (shales) and aid in the stabilization of the horizontal section of the hole. Drilling fluids utilized in the oil-based mud (OBM) system would be contained in steel tanks on location designed specifically for the storage and/or containment of these oil-based

fluids. As stated above, the OBM fluids would be recycled during the drilling operation to separate the drilled cuttings from the fluids and the recovered fluids would be recycled back into the mud tanks for continued use in the drilling operation.. The segregated cuttings would be temporarily collected in steel tanks/bins on the well location pending solidification and disposal following the completion of the drilling operation as described below. Upon completion of drilling operations, any remaining oil-based fluids would be removed from the well location and either recycled into the OBM system on a subsequent well or disposed of in accordance with BLM and/or Wyoming Oil and Gas Conservation Commission (WOGCC) rules and regulations pertaining thereto. A plastic/vinyl liner as per BLM requirements would be placed underneath all steel tanks designed for the storage and/or mixing of the oil-based drilling fluids and/or segregated cuttings in order to protect the underlying soils from incidental leakage.

2.1.2.2 Cuttings Treatment and Disposal

As the drilled cuttings accumulate in the steel bins (mixing tank) during the drilling operation, fly-ash would be mixed with these cuttings in order to solidify them and render them inert (see discussion below regarding the solidification technique). Following solidification, the inert cuttings would then be transferred from the mixing tank to a temporary, above-ground holding area pending burial upon the conclusion of drilling operations (see Appendix A). This holding area would be large enough to contain the volume of cuttings generated by the drilling operation and would be enclosed on all four sides with an earthen berm for containment purposes. The soil used to construct these berms would be obtained from the well location in conjunction with pad construction and would be incorporated back into the reclaimed portion(s) of the well pad following interim reclamation (see Appendix B). The temporary holding area would be lined with an impervious (plastic/vinyl) liner as per BLM requirements.

SRC intends to utilize a solidification technique incorporating fly ash for the processing and disposal of all cuttings generated in conjunction with the drilling operation. Use of the fly ash solidification technique would render these drilled cuttings into an inert, solid mass that would be buried in place in the cuttings pits with a minimum of three feet of overburden upon completion of the solidification process. Solidification of these cuttings would be accomplished in accordance with WOGCC rules and regulations pertaining thereto using a WOGCC approved contractor for solidification and subsequent pit closure.

Solidification would be accomplished through the controlled addition of fly ash to the drilled cuttings to form a homogenous slurry similar to brick mortar. Oily substances that could be present in the OBM drilled cuttings (waste) would be broken up into small droplets or particles and dispersed throughout the reagent/waste mixture during the mixing phase of the process. After the mixing phase, an irreversible cementitious reaction would begin to occur between the reagent and water present (or added) to the waste, ultimately causing the reagent/waste mixture to be transformed into a solid granular material within forty-eight hours after initial processing. Any dispersed particles of hydrocarbons within the processed granules are locked in place in their isolated state within the reacted cementitious matrix of each granule which prevents them from re-coalescing and suddenly being released to the environment at significant rates in the future. Moreover, the alkaline nature of the cementitious mixture chemically stabilizes various metals that

may be present in the processed waste, primarily by transforming them into less soluble metal hydroxides and other less soluble compounds.

Upon completion of the drilling operation, all solidified cuttings generated in conjunction therewith would be moved from the temporary holding area and placed in one of the two separate cuttings pits to be constructed as shown in Appendix A, with one cuttings pit constructed for each individual well. Following construction and prior to use, these cuttings pits would be lined with an impervious (plastic/vinyl) liner as per BLM requirements in order to prevent the seepage of any remaining fluids and subsequent contamination of the underlying soil material. The liner would be installed with sufficient bedding (either straw or dirt) to cover any rocks, would overlap the pit walls and would be covered with dirt and/or rocks to hold it in place. All liners would comply with the minimum state/federal standards applicable thereto.

Excavation of each cuttings pit and the subsequent burial of the solidified cuttings would occur immediately following the completion of drilling operations for each individual well, with these pits only constructed as needed immediately prior to burial of the drilled cuttings. Backfilling would then be accomplished by removing any free-standing water that may have accumulated in the pit, folding the excess liner back over the cuttings and backfilling with the soil material removed upon pit construction. Cuttings disposal and backfilling of both cuttings pits should be accomplished within approximately sixty days following the removal of the drilling rig from the well location and prior to the installation of production equipment on the location.

2.1.2.3 Casing and Cementing Operations

As indicated above, surface casing would be set at an approximate depth of 2,000 feet and cemented back to the surface during the drilling operations. This would serve to isolate all near surface fresh water aquifers which could occur in the immediate project area. Intermediate casing would be set to a measured depth (MD) between 7,000 and 12,000 feet and would also be cemented in place, with the top of cement designed to be above the top of the Fox Hills Fm. This procedure would eliminate any possibility for fluid communication between potential hydrocarbon bearing zones below the Fox Hills Fm and any near-surface fresh water aquifers which may be encountered down hole. The cementing operations would be conducted in full compliance with *Onshore Oil and Gas Order Number 2*.

2.1.3 Completion and Evaluation Operations

Once a well has been drilled and cased, a completion (work-over) unit would be moved onto the well location and completion operations would commence. These completion operations would generally require an average of thirty (30) days for wells of this depth and would typically consist of cleaning out the well bore, pressure testing the casing, perforating and fracturing (as appropriate) the Sussex Fm in the horizontal portion of the hole and running production tubing in the event that commercial production is established there from.

In conjunction with these completion operations, SRC may elect to hydraulically fracture selected intervals within the targeted formation in order to “stimulate” production. These hydraulic fracturing (frac) jobs would typically consist of pumping a mixture of sand and water down hole under pressure with this mixture forced through the existing perforations or ports into the formation. As the formation is fractured, the resultant fissures (fractures) are filled with sand which props them open and facilitates the flow of oil/gas into the well bore and subsequently to the surface.

For those horizontal wells drilled in the Sussex Fm, SRC would conduct “fracing” operations on the entire length of the lateral (horizontal well bore) in stages commencing at the terminus of the well bore (bottom hole location) and working backwards to the beginning of the lateral section. A combination of fresh water, sand (proppant) and selected additives (including potassium chloride resulting in a 3% KCl solution as the base frac fluid) would be used to fracture the Sussex Fm and stimulate production there from. These additives would be mixed in steel tanks on location immediately prior to the completion operation and would not be introduced into any surface pits on the existing well location.

A freshwater reservoir would be constructed on each horizontal well location to hold the estimated 35,000 barrels (1.47 million gallons) of water required for the fracing operation on each horizontal well. This water would be obtained from commercial sources within the overall project area and no water would be diverted from the North Platte River or its tributaries under any circumstances.

Upon completion of the fracturing operation, the well would be flowed back to the surface through temporary production equipment in an attempt to recover as much of the frac fluids as possible and to clean excess sand out of the lateral prior to setting production equipment on location and commencing production. All fluids returned during the flow-back procedure would be captured in steel tanks situated on the well location, with these recaptured fluids ultimately disposed of in strict accordance with both BLM and WOGCC rules and regulations applicable thereto. Any fresh water remaining in the frac reservoir following the cessation of completion operations would be utilized for future completion activities on other wells within the overall project area with the proper approvals from the BLM and/or WOGCC as appropriate. The fresh-water pit used in completion operations would not remain open for more than six months following completion operations unless approved by the AO.

2.1.4 Production Operations

Production equipment required on the individual well locations would typically include the following equipment:

- a pumping unit at the well head for each individual well;
- a portable LACT (Lease Automated Custody Transfer) unit for each individual well;
- a heater/treater for each individual well;

- a tank battery which would generally consist of six 400 barrel steel tanks/well. These tanks would typically all be located together and would be isolated for each particular well with a LACT unit to prevent the commingling of oil produced from each individual well as required by the Authorized Officer, BLM.
- a flare stack; and
- meter runs for gas sales from each individual well bore if/where applicable (see Appendix B).

All permanent above ground production facilities installed on the producing well location would be painted one of the standard environmental colors recommended by the Rocky Mountain Five-State Interagency Committee to be selected at the discretion of the BLM. A dike would be constructed completely around those production facilities designed to hold fluids (i.e., production tanks and/or heater/treater). These dikes would be constructed of either compacted subsoil or some other impervious material, hold 110% of the capacity of the largest tank, and would be independent of the back cut. Load out lines would be located outside the tank battery dike and would have a heavy screen-covered drip barrel installed under the outlet. A metal staircase would be placed over the dike to protect the dike as well as support the tanker truck flexible hose.

Oil produced from each well would be collected in tanks installed on the individual well locations and would be periodically trucked to a pre-existing oil terminal for sales. The frequency of trucking activities would depend solely upon the amount of oil being produced from each individual well. Recent production tests from the HR Federal #44-29H indicate that commercial quantities of natural gas may be expected from some horizontal completions in the Sussex Fm.

2.1.4.1 Pipelines

SRC expects that gas sales from these wells would be accomplished through the installation of a gas gathering system within the overall project area designed to collect the natural gas produced from each individual well and transport said gas to a main truck line that would then transport the gas to tie-in points with a third party natural gas transmission line. Some of the gas produced may be used on location to power equipment on the well location including the heater-treater, pumping unit and a temporary electrical generator necessary to power the pumping unit and portable LACT (lease automatic custody transfer) unit, which is being required by the Authorized Officer (AO), BLM for oil measurement and royalty accounting purposes. The remaining gas would be metered on lease for royalty accounting purposes and would then be introduced into the gas gathering system for sales.

The gas gathering system is anticipated to consist of a buried polyethylene line of varying sizes (determined by gas volumes) that will gather the gas from each individual well location and transport said gas to the main eight inch trunk line. These gathering lines would be installed in a twenty-five (25) foot right of way (ROW) directly adjacent (parallel) to the access road(s) to the greatest extent possible. There will be instances where installation of the gathering lines

adjacent to the access roads may not be practical or feasible, in which case they would be installed cross-country to the tie-in point with the main truck line. Installation of these cross-country lines would require a total disturbed ROW width not to exceed fifty (50) feet.

In those cases where the gathering lines would cross federal surface estate, approval of the BLM AO would be required prior to the installation thereof. Generally speaking, gathering lines crossing on-lease fee (private) surface estate may be subject to BLM approval prior to installation.

SRC estimates that approximately 100 miles (528,000 feet) of pipelines (including both gathering and trunk lines) would be installed within the overall project area, with approximately 60% of these lines (60 miles or 316,800 feet) of line installed parallel to existing/proposed access roads and the remaining line installed cross-country. Considering that all disturbances associated with pipeline construction would be reclaimed and reseeded as soon as practical following installation, these disturbances are considered as Short-Term in nature and are not included in the Life of Project (LOP) cumulative disturbance totals in Chapter Four.

The main trunk line would be designed to transport the gathered gas from wells within the overall project area would consist of an eight inch polyethylene line and would transport the gas to a tie-in with an existing DCP Pipeline at points located in the SW $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 34 in Township 38 North, Range 73 West and also in the SE $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 25 in Township 37 North, Range 73 West. The proposed trunk line would cross approximately 2,688 feet of federal surface in Sections 3 (SW $\frac{1}{4}$ NW $\frac{1}{4}$) and 4 (SE $\frac{1}{4}$ NE $\frac{1}{4}$ and SE $\frac{1}{4}$ SE $\frac{1}{4}$) of Township 37 North, Range 73 West. SRC has submitted an Application for Right-of-Way to the BLM AO for the installation of this segment of the overall trunk line. The remainder of the line crosses either State of Wyoming or fee (private) surface estate, and is not subject to federal approval authority.

In those cases where commercial quantities of gas were not encountered, small (non-commercial) volumes of gas would be flared in accordance with Notice to Lessees (NTL) 4A.

A minimum of 6 inches of topsoil would be stripped from the pipeline ROW prior to the commencement of construction activities. Once trenching and pipe installation operations have been completed, the trench would be backfilled with the subsoil materials previously removed there from, the trench would be compacted to avoid settling, and the stockpiled topsoil redistributed over the disturbed ROW. The pipeline ROW would then be reseeded as soon as practical thereafter in accordance with the seeding recommendations obtained from either the private surface owner or the BLM as appropriate.. Considering that all disturbances associated with pipeline construction would be reclaimed and reseeded as soon as practical following pipe installation, these disturbances are considered as Short-Term in nature and are not included in the Life of Project (LOP) cumulative disturbance totals in Chapter Four.

SRC does not anticipate the need for any compression at this point in time for gas sales.

2.1.4.2 Power Lines and Temporary Power

As stated above, SRC intend to utilize electricity to power equipment on each individual well location including the pumping unit, the portable LACT unit required by BLM for each well head, and safety equipment for the production vessels including high/low volume and pressure alarms and automatic shutdowns.

Unfortunately, the existing power grid within the Hornbuckle Field is not sufficient to meet the expected power requirements anticipated in conjunction with the current production scenario and Rocky Mountain Power (RMP) currently estimates that it could be two years or more before they can install a new line (or upgrade their existing delivery system) to bring the required electrical power into the project area. The additional power could come in the form of a new power line installed from the Antelope substation (located approximately in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 34, T40N, R71W) to the north and terminating somewhere in the vicinity of Section 21 in Township 38 North, Range 73 West or through the upgrade of an existing power line coming from the Yellow Cake substation to the south substation (located approximately in the NE $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 28, T36N, R73W) and terminating somewhere in the vicinity of Section 33 in Township 38 North, Range 73 West. Any permitting requirements for said line(s) would be the responsibility of RMP as the third-party supplier. As above, any federal lands crossed on/along the proposed power line would require an approved ROW application from the BLM AO prior to the installation thereof. Power lines crossing fee (private) surface estate would not be subject to BLM approval prior to installation.

SRC anticipates that RMP would “drop” power at several as yet unspecified points within the overall project area, including two drops in the Hornbuckle Field and one outside of the field proper. SRC would then route power from these drop points to each individual well location within the project area. A combination of overhead and buried lines would be utilized as necessary or appropriate to route power to each well location - with the actual routing determined largely by the location of these drops and subsequent negotiations with the affected private surface owners. SRC anticipates a “fish bone” power grid configuration where power will be run from each drop and individual lines run from the “spine” down to individual well locations. Any buried lines will follow existing access roads to the greatest extent possible and would be buried in a common trench with the gas gathering lines. All overhead lines will be installed in accordance with current Raptor Protection Guidelines in order to minimize the possibility of electrocutions within the project area.

As above, any federal lands crossed on/along these proposed power line(s) would require an approved ROW application from the BLM AO prior to the installation thereof. Power lines crossing fee (private) surface estate would not be subject to BLM approval prior to installation.

SRC estimates that approximately 75 miles (396,000 feet) of power lines would be installed within the overall project area (excluding any RMP lines), with approximately 50% of these lines (37.5 miles or 198,000 feet) of line installed overhead and the remaining line buried as discussed above. Considering that all disturbances associated with power line construction would be reclaimed and reseeded as soon as practical following installation, these disturbances are considered as Short-Term

in nature and are not included in the Life of Project (LOP) cumulative disturbance totals in Chapter Four.

Where applicable, SRC will utilize temporary generators on each individual well location until such time as RMP is able to “drop” overhead power into the project area and they are able to install the permanent electrical power supply. These 150 kW generators would be low emission models designed to run on natural gas and one generator would be required for each individual well bore/portable LACT unit. SRC estimates that 22 generators would be required in the first year of operation as wells are drilled and competed with an additional 22 generators/year added in the second and third year of operator. These generators would be removed once the permanent electrical lines have been installed to the individual well locations.

2.1.5 Interim Reclamation for Production

All disturbed surfaces would be reclaimed as soon as possible after the initial disturbance. This reclamation would consist primarily of backfilling the cuttings and frac water pits, leveling and recontouring of “non-working” disturbed areas, redistribution of stockpiled topsoil over these disturbed areas, installation of erosion control measures, and reseeding as recommended by the BLM and/or private surface owner. Approximately 2.10 acres of the well pad (51.1% of the level pad area) would be required for long-term production operations, the remaining 2.21 acres of the constructed well pad would be reclaimed as indicated above. Solidification and subsequent reclamation of the cuttings pits would be accomplished as soon as possible following well completion. Solidification would be accomplished as outlined in Section 2.1.2.1 and the cuttings pits would be backfilled immediately upon completion of the solidification process.

Interim reclamation of the well location including reduction of the cut and fill slopes, redistribution of the stockpiled topsoil over the recontoured slopes, and reseeding of these disturbed areas would be accomplished within a maximum of two years following the termination of drilling and completion operations on the initial well (see timing discussion in Section 2.1). As indicated above, approximately 2.21 acres of the existing well pad would be reclaimed and reseeded in accordance with the guidelines contained in the approved APD.

Likewise, topsoil stockpiled in conjunction with initial road construction would be re-distributed over the outslope areas of the borrow ditches and these areas would also be reseeded as recommended in the approved APD. Reclamation of these outslope areas along the access road would reduce the overall disturbed road ROW width from approximately 40 feet to approximately 28 feet and would reduce the long-term disturbance associated with each individual access road ROW to approximately 0.93 acres per well.

The working area(s) of the well pad and the access road running surface would be surfaced with gravel or crushed rock and these surfacing materials would be obtained from a previously approved location within the general area. As stated in Section 2.1.1.1, crushed rock (gravel) is currently being obtained from the Knife River quarry located in Sections 13, 23, 24 and 26 in Township 33 North, Range 76 West.

2.1.6 Abandonment and Reclamation

Upon final abandonment of each well, all existing surface facilities would be removed from the well location, the well bore would be physically plugged with cement as directed by the BLM, and a dry hole marker would be set in accordance with existing regulations and direction contained in the approved APD. Upon completion of plugging operations, both the access road and remaining “work” areas of each abandoned well location would be scarified and recontoured, erosion control measures would be installed as necessary, and all recontoured (disturbed) areas would be reseeded as recommended by the BLM and/or private surface owner. However, there may be certain circumstances where the private surface owner may wish to retain specific access roads for future use at the time of final abandonment.

2.1.7 Hazardous Materials

SRC has reviewed the Environmental Protection Agency’s (EPA’s) Consolidated List of Chemicals Subject to Reporting Under Title III of the *Superfund Amendments and Reauthorization Act* (SARA) of 1986 (as amended) to identify any hazardous substances proposed for production, use, storage, transport, or disposal by this project, as well as the EPA’s List of Extremely Hazardous Substances as defined in 40 CFR 355 (as amended) and has determined that none of the materials listed as hazardous and/or extremely hazardous would be used or generated by this project. Handling of oil and gas exploration and production (E&P) wastes would conform to the guidelines set out in the revised publication of May 1994 titled *IOGCC Environmental Guidelines for State Oil & Gas Regulatory Program*.

2.1.8 Ancillary Facilities

SRC is proposing to build a storage yard in the NW $\frac{1}{4}$ NW $\frac{1}{4}$ of Section 33 in Township 38 North, Range 73 West for the storage of equipment and materials normally used in conjunction with oil/gas operations. The area selected for the storage yard would be located on private surface estate and would encompass approximately 4.61 acres. This area has seen some previous surface disturbance associated with the construction of the proposed HB KH Ranch Fee #11-33H well location by Southwestern Production Corporation (SWPC) in 2007. The location was apparently constructed but never drilled by SWPC and complete reclamation of the well pad/access road route was never accomplished. Access to the storage yard would be obtained via an existing, upgraded oilfield road and the entire area would be fenced as specified in Section 2.1.1.2. Some additional surface disturbance may be necessary in order to fully utilize the entire area inside the perimeter fence and any construction activities necessary in this regard would be conducted in accordance with standard construction methods outlined in Section 2.1.1.2. As the affected area is located on private surface estate, no federal approvals would be required prior to the construction and use thereof and it is entirely likely that the storage yard will be installed prior to the completion of this analysis document..

SRC is also proposing to install a field office in the SE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 27 in Township 38 North, Range 73 West for the use of the SRC Field Foreman and other personnel. As with the

proposed storage yard, the office area would be located on private surface estate, would encompass approximately 1.00 acre, and would involve setting a 14" X 64" modular unit that would serve as the field office for SRC. This area is undisturbed and new construction would be required in conjunction with the establishment of a field office at this location. Access to the field office would involve the construction of approximately 1,262 feet of new road resulting in approximately 1.16 acres of additional surface disturbance. Access road construction would generally be in accordance with the road construction standards outlined in Section 2.1.1.1. As the affected area is located on private surface estate, no federal approvals would be required prior to the construction and use thereof and it is also likely that the office will be installed prior to the completion of this analysis document.

SRC would obtain the necessary permits from the Wyoming Department of Environmental Quality (WDEQ) for the disposal of human waste associated with a permanent modular office to be installed on this site. The permit approval(s) would typically involve the installation of a septic system and accompanying leach field for wastewater treatment and disposal and said approvals would be obtained from the WDEQ prior to the installation of the modular unit.

No man camps or other ancillary facilities are planned within the overall project area at this time.

2.2 THE NO ACTION ALTERNATIVE

Under the No Action Alternative, the Proposed Action would not be implemented and the additional wells currently proposed in and adjacent to the Hornbuckle Field would not be approved. Current land use practices would continue, and minerals within the overall analysis area would continue to be available for oil and gas exploration and development. Should future development be proposed, those actions would require individual NEPA analyses on a case-by-case basis.

3.0 AFFECTED ENVIRONMENT

This chapter describes the affected environment in the vicinity of the Proposed Action (the project area) as it exists today, where pertinent existing development, impacts, and disturbances are described. This description is organized by resource with descriptive information taken from a wide range of sources including the BLM and various other federal and state agencies as appropriate.

Critical elements of the human environment, their status in the Project Area, and their potential to be affected by the Proposed Action are listed in Table 3.1.

Table 3.1

Critical Elements of the Human Environment ¹

Critical Element	Status on the Project Area	Addressed in Text of EA
Air Quality	Not Affected	Yes
Areas of Critical Environmental Concern	None Present	No
Cultural Resources	Potentially Affected	Yes
Environmental Justice	Not Affected	Yes
Farmlands, prime or unique	None Present	No
Floodplains	Not Affected	No
Native American Religious Concerns	Not Affected	Yes
Invasive Non-Native Species	Potentially Affected	Yes
Threatened and Endangered Species	Potentially Affected	Yes
Wastes, hazardous or solid	None Present	No
Water Quality (surface and ground water)	Potentially Affected	Yes
Wetland/Riparian Zones	Not Affected	No
Wild and Scenic Rivers	None Present	No
Wilderness	None Present	No

¹ From the BLM NEPA Handbook H-1790-1 (BLM 1988, 1999a).

3.1 ENVIRONMENTAL ELEMENTS CONSIDERED WITH MINOR EFFECTS

The following resources would not be adversely affected by implementation of the Proposed Action. As a consequence, these resources will be addressed briefly in this section but will not be addressed in Chapter 4.0 (Environmental Consequences).

3.1.1 Recreation

The general project area consists of a mosaic of fee, state, and federal lands, with those federal lands located within the project area generally isolated due to a lack of a public access thereto and access is strictly controlled by the private surface owners in the area. Moreover, considering that there are no special recreation management areas or developed recreational sites within the project area and the ownership patterns, recreational opportunities are somewhat limited and would not be adversely affected by the Proposed Action.

3.1.2 Socio-Economics

Neither the economy of Converse County nor the quality of life for the residents thereof would be adversely affected by the Proposed Action. As described in Chapter 2.0, additional oil/gas exploration and development activity in the overall project area would not result in an increase in the local workforce, with an associated burden on the resources of Converse County and/or the infrastructure thereof. In point of fact, implementation of the Proposed Action would actually have a positive impact on the economy of Converse County through increased revenues generated by additional hydrocarbon production should any/all of the proposed wells prove to be commercially productive.

3.1.3 Visual Resources

The overall project area is within a Class IV Visual Resource Management (VRM) area where changes may subordinate the original composition and character of the basic elements of the landscape, but must reflect what could be a natural occurrence within the characteristic landscape (BLM 1982). No impacts to Visual Resources would result from the Proposed Action considering that the project area is well removed from public roads within this area of northern Converse County, combined with the fact that all permanent above-the-ground structures (not subject to safety considerations) would be painted a flat, non-reflective earth tone color (see Section 2.1.4).

3.2 AIR QUALITY

No site-specific air quality data are available from the proposed project area; however, air quality in the area is generally good and is in compliance with state and national ambient air quality standards.

The principal air-borne pollutant within the proposed project area is particulate matter in the form of fugitive dust (uncontrolled wind-carried particulates) generated from natural and human sources. Visibility in the region is typically very good (> 70 miles) and fine particulates are generally considered to be the main source of visibility degradation (BLM 1985).

Current national and state air quality standards are presented in Table 3.2.

Table 3.2**Selected National and Wyoming Ambient Air Quality Standards**

Air Pollutant	Averaging Time Period	NAAQS ¹	WAAQS ²	Unit of Measurement
Particulate matter <10 microns in diameter (PM ₁₀)	24-hour	150	150	Micrograms per cubic meter
	AAM ³	ns	50	Micrograms per cubic meter
Particulate matter <2.5 microns in diameter (PM _{2.5})	24-hour	35	35	Micrograms per cubic meter
	AAM	15	15	Micrograms per cubic meter
Ozone	1-hour	120	ns	Parts per Billion
	8-hour	75	80	Parts per Billion
Nitrogen dioxide (NO ₂)	1-hour	100	ns	Parts per Billion
	AAM	53	53	Parts per Billion
Sulfur dioxide (SO ₂)	1-hour	75	Ns	Parts per Billion
	3-hour	500	500	Parts per Billion
	24-hour	140	100	Parts per Billion
	AAM	30	20	Parts per Billion
Carbon monoxide (CO)	1-hour	35	35	Parts per Million
	8-hour	9	9	Parts per Million

¹ NAAQS = National Ambient Air Quality Standards (adapted from 40 CFR 50.5-50.12). Primary standard unless otherwise noted. National Primary Standards establish the level of air quality necessary to protect public health from any known or anticipated effects of a pollutant, allowing a margin of safety to protect sensitive members of the population.

² WAAQS = Wyoming Ambient Air Quality Standard (adapted from WDEQ 2010).

³ AAM = annual arithmetic mean.

ns = no standard.

Both Converse County and the overall project area are considered to be in attainment with State of Wyoming and National Ambient Air Quality Standards (EPA 2011).

3.3 GENERAL SETTING OF THE PROJECT AREA

The general project area is located approximately twenty (20) miles west of Bill, Wyoming and twenty-seven miles north/northeast of Glenrock, Wyoming at elevations ranging from a low of 4,884' in the NE¼ of Section 6, Township 37 North, Range 72 West to a high of 5,512' in the SE¼ of Section 32 in Township 37 North, Range 73 West. The project area is generally situated on the southern flank of the Cheyenne River Divide in an area of gently to moderately rolling uplands. Drainage in the area is to the northeast via four intermittent tributaries of the Cheyenne River including (from north to south) the South Fork of Bear Creek, the Dry Fork Cheyenne River, Brush Creek and Duck Creek.

The overall project area is situated within the Powder River Basin, a Level IV Eco-Region located within the Northwestern Great Plains Level III Eco-Region - an area of rolling plains (short-grass prairie) that is predominately used for dryland farming and livestock grazing (EPA 2009). Mean annual precipitation in the Powder River Basin (1961-1990) averaged between eleven and fifteen inches, mean annual temperature (1961-1990) averaged between 45° and 50° Fahrenheit (F) with 151 to 170 annual days with a minimum temperature at 32°F or below and 29 to 35 annual days with a maximum temperature above 90°F (Curtis et al. 2004).

The Powder River Basin Eco-Region is a generally classified as a western mixed-grass/short-grass prairie with vegetation in the specific project area characterized by blue grama (*Bouteloua gracilis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), fringed sagewort (*Artemisia frigida*), green needlegrass (*Nassella viridula*), Hood's phlox (*Phlox hoodii*), little bluestem (*Schizachyrium scoparium*), prairie junegrass (*Koeleria macrantha*), prairie sandreed (*Calamovilfa longifolia*), needle-and-thread (*Stipa comata*), threadleaf sedge (*Carex filifolia*) and western wheatgrass (*Pascopyrum smithii*). Non-grass/forb species found in the upland areas include prickly pear cactus (*Opuntia* sp.), sagebrush (*Artemisia* sp.), yucca (*Yucca* sp.) and broom snakeweed (*Gutierrezia saraothrae*), with cottonwood trees (*Populus* sp.) found along the major drainages including Duck Creek and the Dry Fork Cheyenne River.

3.4 EXISTING OIL/GAS DEVELOPMENT IN THE OVERALL PROJECT AREA

As stated in Section 1.2, the overall project area is situated in Township 37 North, Ranges 72 and 73 West, Township 38 North, Range 73 West and encompasses approximately 72 sections or 46,080 acres (+/-) of mixed federal, state and fee surface/mineral estate in northern Converse County, Wyoming. According to the electronic records of the Wyoming Oil and Gas Conservation Commission (WOGCC 2011), approximately 107 oil/gas wells have been drilled or are currently drilling in the overall project area. A breakdown of these wells is as follows:

- 38 wells that have been plugged and abandoned;
- 29 producing oil wells owned/operated by Samson Resources Company (SRC);
- 22 producing oil wells owned/operated by other companies;
- 9 drilling permits submitted by SRC as confidential (current status unknown);
- 2 wells that have been spudded by SRC;
- 2 shut-in oil wells owned/operated by SRC;
- 2 shut-in oil wells owned/operated by other companies;
- 1 producing gas well owned/operated by another company;
- 1 producing coal bed natural gas (CBNG) well owned/operated by another company; and

- 1 shut-in CBNG well owned/operated by SRC.

Past drilling activity in this area has tested Upper Cretaceous formations at depths ranging between 7,800 and 14,000 feet for potential hydrocarbon production. The electronic records of the WOGCC report oil/gas production from the Teapot, Parkman and Sussex Formations - with the Sussex Formation (Fm) being the most prolific oil producing formation in the overall project area (WOGCC 2011). A breakdown of production by formation is as follows:

- 42 producing wells - Sussex formation;
- 5 producing wells - Parkman formation;
- 2 producing wells - Muddy formation;
- 1 producing well - Teapot formation; and
- 1 producing well - Dakota formation.

Specific information on the history of the Hornbuckle Field was contained in the Environmental Assessment of Southwestern Production Corporation's Proposed Eight Well Horizontal Drilling Program in the Hornbuckle Field, Converse County, Wyoming (BLM 2009).

3.5 CULTURAL RESOURCES

All lands addressed in this environmental analysis have the potential to contain surface and buried archeological materials. The Wyoming State Historic Preservation Office (SHPO) Records Division database was checked for information on previous surveys and recorded cultural resources within the EA boundaries. Those database records indicate that of the 46,080 acres encompassing the overall project area, approximately 5,963 acres (13%) have been previously surveyed to present-day Class III standards since 1980 in blocks of 10 acres or more. These block surveys have been conducted for well pads, uranium mines and land exchanges. An additional 29 cultural surveys have been conducted for linear projects including access roads, pipelines, powerlines and seismic lines since 1980. Of these previous projects, 21 have been conducted on federal wells staked in conjunction with the Proposed Action by both SRC and their predecessor Southwestern Production Corporation (SWPC). All previous inventories were conducted in compliance with the *National Historic Preservation Act* (NHPA). Copies of the individual cultural resource inventory reports are currently on file with both the BLM CFO in Casper, Wyoming, and the Wyoming State Historic Preservation Office (SHPO) Records Office in Laramie, Wyoming.

Prior inventories within the boundaries of the Proposed Action have located 42 sites and several isolated artifacts. Site types reported during those surveys include lithic scatters (11), habitation sites (usually identified as those with lithic artifacts, burned rocks and hearths) (7), stone circles (1), rock cairns (9), a WWII bombing site (1), historic artifact scatters (2), herder camps (2), a historic bridge (1), homesteads (4) and historic ranching facilities (4). Previously recorded

diagnostic artifacts include an Agate Basin point and a lanceolate midsection dating from the Paleoindian Period (11,000 - 6,000 B.C.). The Archaic Period (6,000 B.C. - A.D. 500) is represented in the records for the proposed project area by Middle Archaic McKean points. Few Late Prehistoric Period (A.D. 500 -1700) arrow points have been recorded, but they are represented. Protohistoric Period (A.D. 1700 - 1806) Native American sites may include some of the lithic scatters, historic artifact scatters and cairns because those sites have not been firmly dated. The Historic Period (A.D. 1806 - 1900) is represented mainly by Euroamerican sites as listed above, but there is also a potential for Native American sites from this period as well. Several sites within the study area exhibit buried cultural deposits up to a meter in depth. Most of these sites have been evaluated as not eligible, but three are unknown and require additional work before determining their eligibility for the National Register of Historic Places (NRHP). The 5,963 acres (+/-) inventoried for cultural resources as block surveys represent only about thirteen (13) percent of the total surface estate included within the overall project area.

3.5.1 Native American Religious Concerns

Native American groups historically associated with this area consider prehistoric rock alignments, rock cairns, rock piles (of various possible functions), stone circles, rock art and potential funerary sites as culturally sensitive. Tribal consultation on sites of these types would be required for evaluation, identification and possible subsequent protection of sensitive cultural sites. Cairns and stone circles have been previously recorded within the proposed project area, and others are likely to be encountered during future inventories. All sites of these types have been recorded within surrounding areas of the Powder River Basin (PRB) and are likely to exist within the proposed Hornbuckle Field Development Project Area (HFDPA).

3.5.2 Historic Trails

The Ross Road generally follows the historically significant Bozeman Trail and is approximately one-half-(0.5) mile west of the HFDPA boundary at its nearest point. The Ross Road is the primary route the public uses for pleasure driving and viewing natural features, scenery, and wildlife associated with the Trail. The public view of the project is mainly limited to the Ross Road due to surface ownership patterns that limits legal access to the area. Activities associated with the Proposed Action would use previously established, improved oilfield and ranch roads that originate at/from the Ross Road, with the result that no new roads would be constructed off of the Ross Road. Additionally, all new activities proposed in conjunction with the Proposed Action would be a minimum of one-half-(0.5) mile from the road and generally separated therefrom by rolling topography. As a result, no physical or visual impacts to the Bozeman Trail would result from activities associated with the Proposed Action. Consequently, the Bozeman Trail will not be discussed further in this analysis document.

3.6 RANGE MANAGEMENT

As indicated in Table 1.1, there are approximately 5,375 acres of surface estate within the overall project area that are owned by the United States of America (excluding the DOE acreage), with 3,755 acres managed by the Bureau of Land Management (BLM) and the remaining 1,620 acres managed by the U.S. Forest Service (USFS). SRC has indicated that surface disturbing activities on the 1,620 acres administered by the USFS will be avoided to the greatest extent possible.

3.6.1 Grazing Allotments and Existing Range Improvements

The 3,755 acres of public land managed by the BLM within the overall project area encompass portions of five separate grazing allotments which are administered by the CFO. Table 3.3 provides general information concerning each grazing allotment within the project area including allotment number, allotment name, number of acres, permitted grazing periods, permitted animal types and numbers for each respective allotment.

Table 3.3

Grazing Allotments and Schedules on Public Lands in the Project Area

Allotment Number	Allotment Name	Acres in Project Area	Grazing Periods	Animal Type	Animal Numbers
0236	Turner Flats	1,680	03/01 to 02/28	Cattle	50
			10/15 to 10/28	Cattle	1
0342	Skunk Creek	60	03/01 to 02/28	Cattle	6
			03/01 to 04/30	Cattle	5
10113	Hornbuckle	1,240	03/01 to 04/20	Cattle	398
			01/01 to 02/28	Cattle	400
			05/01 to 10/31	Sheep	150
			04/01 to 12/31	Horse	1
10155	Box Creek ¹	20	03/01 to 02/28	Cattle	5
			03/01 to 05/30	Cattle	1
10168	Monument Hill	755	03/01 to 02/28	Cattle	54
			03/01 to 10/31	Cattle	1

¹ Unit 5 Pasture

These allotments are located on federal (BLM) lands located within those portions of the project area included within Township 37 North, Ranges 72 and 73 West. Based on an average of 3.30

acres/Animal Unit Month (AUM) within these allotments, the 3,755 acres of public land supports approximately 1,138 AUM's.

Existing range improvements on those BLM lands included within the overall project area would generally include four fence projects (including Duck Creek Ranch Fence PR #964628, Manning Fence PR# 961024, Manning Fence PR #961035 and Reynolds Fence PR #960703); one pipeline (Manning Pipeline PR#695762); one spring (Reynolds Spring PR #960705) and one reservoir (Reynolds Reservoir PR #960704).

Existing range improvements on non-federal lands included within the overall project area would generally include buried water pipelines, fences (pasture and/or /boundary fences), reservoirs, stock tanks and water wells. There are approximately 42 permitted stock water wells that have been drilled and completed on non-federal lands throughout the project area (see Section 3.8.2), with these wells ranging in depth from 44 to 1,000 feet. The average depth of these wells is approximately 344 feet. (WSEO 2011).

3.6.2 Invasive, Non-Native Species

Non-native plant species that are difficult to control, easily spread, and injurious to public health, crops, livestock, land or other property have been designated as noxious weeds under the Wyoming Weed and Pest Control Act of 1973. Prohibited noxious weeds pursuant to Wyoming Statute (W.S.) 11-12-104 are identified in Table 3.4.

To our knowledge, no surveys have been conducted within the overall project area to determine either the presence or absence of those noxious weeds identified in Table 3.4.

3.7 SOILS

The Powder River Basin exhibits a wide range of soils which are directly associated with the topography. Variations in soils are due to the differing origins of parent materials, different climatic conditions, and the effects of different types of vegetation. In this regard, a Third Order Soils Inventory of Converse County, Wyoming, Northern Part has been published by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS 1986). This soils inventory identified 52 separate soil mapping units in Northern Converse County arising from 44 separate taxonomic soil units (not including Rock Outcrop).

Of the 52 separate soil mapping units identified within northern Converse County, approximately 36 (69%) are found within the overall project area. Considering the overall size of project area (+/- 46,080) acres and the fact that the component parts of the Proposed Action (access roads, well locations, etc.) have not all been selected, the discussion of soils will be limited to those general soils identified in the project area by the NRCS (1986) for the purposes of this analysis.

Table 3.4

Invasive Non-Native Species (Noxious Weeds) ¹

Common Name	Scientific Name
Field bindweed	<i>Convolvulus arvensis</i> L.
Canada thistle	<i>Cirsium arvense</i> L.
Leafy spurge	<i>Euphorbia esula</i> L.
Perennial sowthistle	<i>Sonchus arvensis</i> L.
Quackgrass	<i>Agropyron repens</i> (L.) Beauv.
Hoary cress (whitetop)	<i>Cardaria draba</i> and <i>Cardaria pubescens</i> (L.) Desv.
Perennial pepperweed (giant whitetop)	<i>Lepidium latifolium</i> L.
Ox-eye daisy	<i>Chrysanthemum leucanthemum</i> L.
Skeletonleaf bursage	<i>Franseria discolor</i> Nutt.
Russian knapweed	<i>Centaurea repens</i> L.
Yellow toadflax	<i>Linaria vulgaris</i> L.
Dalmatian toadflax	<i>Linaria dalmatica</i> (L.) Mill.
Scotch thistle	<i>Onopordum acanthium</i> L.
Musk thistle	<i>Carduus nutans</i> L.
Common burdock	<i>Arctium minus</i> (Hill) Bernh.
Plumeless thistle	<i>Carduus acanthoides</i> L.
Dyers woad	<i>Isatis tinctoria</i> L.
Houndstongue	<i>Cynoglossum officinale</i> L.
Spotted knapweed	<i>Centaurea maculosa</i> Lam.
Diffuse knapweed	<i>Centaurea diffusa</i> Lam.
Purple loosestrife	<i>Lythrum salicaria</i> L.
Saltcedar	<i>Tamaxix</i> ssp.
Common St. Johnswort	<i>Hypericum perforatum</i>
Common tansy	<i>Tanacetum vulgare</i>
Russian olive	<i>Elaeagnus angustifolia</i> L.

¹ From the Wyoming Weed and Pest Council website: www.wyoweed.org.

The 52 soil mapping units and 44 taxonomic soil units referenced above are included within nine general map units - four of which occur within the overall project area in order of occurrence as follows

- 54.7%: Hiland-Shingle-Ulm;
- 22.2%: Tassel-Hiland-Vonalee;
- 21.7%: Forkwood-Cushman-Hiland; and
- 1.4%: Ulm-Bidman-Renohill.

The Hiland-Shingle-Ulm general map unit consists of deep and shallow, well drained, nearly level to hilly soils which are located on uplands and adjacent foot slopes, toe slopes and alluvial flats. These soils are found in areas of dissected uplands throughout the project area. Access by roads and trails is generally good in this unit (NRCS 1986).

The Tassel-Hiland-Vonalee general map unit consists of shallow and deep, well drained and somewhat excessively drained, undulating to hilly soils which are located on uplands. These soils are found in areas of dissected uplands throughout the project area. Paved roads, improved dirt roads and trails provide good access to this unit (NRCS 1986).

The Forkwood-Cushman-Hiland general map unit consists of deep and moderately deep, well drained, nearly level to rolling soils which are located on uplands. Access by improved roads and trails is generally good in this unit (NRCS 1986).

The Ulm-Bidman-Renohill general map unit consists of deep and moderately deep, well drained, nearly level to hilly soils which are located on uplands and adjacent foot slopes, toe slopes and alluvial flats. Access by roads and trails is good in this unit (NRCS 1986).

Additional information regarding the physical characteristics of individual soils within each of these soil mapping units may be obtained from the *Soil Survey of Converse County, Wyoming, Northern Part* published by the U.S. Department of Agriculture, Natural Resources Conservation Service in 1986 in cooperation with the U.S. Forest Service, U.S. Department of the Interior, BLM and the Wyoming Agricultural Experiment Station (NRCS 1986).

3.8 WATER RESOURCES

3.8.1 Ground Water Resources

The Eocene Wasatch Fm is found at the surface throughout the overall project area. While the Wasatch Fm is known to be an important aquifer in other areas, it is believed that the majority of the formation has weathered away through geologic time leaving a shallow, remnant deposit on the surface within the project area - with the actual depth of this remnant deposit unknown.

The Wasatch transitions into the Paleocene Fort Union Fm just below the ground surface, which extends approximately 6,200 feet to the top Cretaceous Lance Fm. The primary, near-surface, fresh water aquifer within the overall project area is the Tongue River Member of the Fort Union Fm from the base of the Wasatch Fm to the top of the Pawnee coal at an approximate depth of 1,000 feet below the ground surface. As stated in Section 3.5.1, a review of the electronic records in the Wyoming State Engineer's office (WSEO) revealed that there are approximately 46 permitted water wells within the overall project area. These water wells are identified in Table 3.5.

Table 3.5**Existing Domestic/Stock Water Wells within the Proposed Project Area ¹**

Permit Number	Permit Type	Legal Location of Water Well				Well Depth
		Quarter	Section	Township	Range	
P145347W	Stock	SW¼NE¼	6	37 North	72 West	495'
P9156P	Stock	NE¼SW¼	7	37 North	72 West	???
P14636P	Stock	NW¼SE¼	19	37 North	72 West	???
P14637P	Stock	SE¼SE¼	30	37 North	72 West	180'
P70352W	Stock	SE¼SW¼	31	37 North	72 West	120'
P19969P	Stock	NW¼NW¼	5	37 North	73 West	200'
P19964P	Stock	SW¼NE¼	8	37 North	73 West	530'
P23698W	Domestic	NE¼NW¼	10	37 North	73 West	300'
P68591W	Domestic	SE¼NW¼	10	37 North	73 West	300'
P9159P	Stock	SE¼NE¼	14	37 North	73 West	250'
P19968P	Stock	SE¼SW¼	17	37 North	73 West	210'
P19965P	Stock	SW¼SE¼	19	37 North	73 West	130'
P114459W	Stock	SE¼NE¼	22	37 North	73 West	77'
P35031W	Domestic	SE¼NE¼	22	37 North	73 West	400'
P9162P	Domestic	SE¼SE¼	22	37 North	73 West	375'
P69509W	Stock	NW¼NE¼	27	37 North	73 West	1,000'
P75999W	Stock	SW¼SW¼	28	37 North	73 West	240'
P96420W	Stock	NW¼NW¼	31	37 North	73 West	170'
P28416W	Stock	SW¼SW¼	31	37 North	73 West	440'
P94860W	Stock	NE¼SW¼	32	37 North	73 West	320'
P9167P	Stock	SW¼SW¼	32	37 North	73 West	175'
P9000P	Stock	SE¼NW¼	8	38 North	73 West	126'
P50198W	Stock	SE¼NW¼	8	38 North	73 West	460'
P1365W	Stock	NE¼NW¼	9	38 North	73 West	443'
P64632W	Stock	SE¼NW¼	9	38 North	73 West	432'
P3632P	Stock	NW¼SE¼	11	38 North	73 West	265'
P84349W	Stock	NE¼NW¼	13	38 North	73 West	960'
P9001P	Stock	SW¼NW¼	14	38 North	73 West	322'
P77359W	Stock	NE¼SE¼	15	38 North	73 West	400'
P21134P	Stock	NW¼NE¼	17	38 North	73 West	515'
P21142P	Stock	NE¼NW¼	18	38 North	73 West	44'
P617W	Stock	SW¼NW¼	20	38 North	73 West	125'
P19972P	Stock	SW¼NW¼	20	38 North	73 West	125'
P48800W	Stock	SW¼SW¼	21	38 North	73 West	400'
P1363W	Stock	NE¼SW¼	23	38 North	73 West	636'
P1362W	Stock	NW¼NW¼	24	38 North	73 West	703'
P99863W	Stock	NW¼NW¼	25	38 North	73 West	704'
P19973P	Stock	SW¼SW¼	27	38 North	73 West	410'
P9164P	Stock	SE¼NE¼	29	38 North	73 West	???
P86571W	Stock	NW¼SW¼	31	38 North	73 West	330'
P19966P	Stock	SW¼NW¼	32	38 North	73 West	205'

Table 3.5 - Continued**Existing Domestic/Stock Water Wells within the Proposed Project Area ¹**

Permit Number	Permit Type	Legal Location of Water Well				Well Depth
		Quarter	Section	Township	Range	
P19977P	Stock	NE $\frac{1}{4}$ NE $\frac{1}{4}$	33	38 North	73 West	300'
P19974P	Stock	SW $\frac{1}{4}$ SE $\frac{1}{4}$	33	38 North	73 West	340'
P19976P	Stock	NW $\frac{1}{4}$ SW $\frac{1}{4}$	33	38 North	73 West	500'
P19963P	Domestic/Stock	SW $\frac{1}{4}$ SW $\frac{1}{4}$	33	38 North	73 West	310'
P19975P	Domestic/Stock	SW $\frac{1}{4}$ SW $\frac{1}{4}$	33	38 North	73 West	540'

1 Data gathered from the computerized records of the Wyoming State Engineer's Office: <http://seo.state.wy.us>.

These wells are being used for either domestic or livestock watering purposes as follows:

- 40 wells permitted solely for livestock watering purposes;
- 4 wells permitted solely for domestic water use; and
- 2 wells permitted for both domestic and livestock watering purposes.

These wells range in depth from a minimum of 44 feet to a maximum of 1,000 feet, with the average depth of these wells calculated at approximately 344 feet (WSEO 2011).

In addition to the water wells being used for domestic or livestock watering purposes within the analysis area, there are an additional 55 wells which have been permitted through the WSEO for monitoring purposes and which are currently still operational. These wells were permitted in conjunction with the following activities:

- Township 37 North, Range 73 West: 17 groundwater monitoring wells drilled in conjunction with uranium mining activities being conducted/proposed by Cameco Resources at their Reynolds Ranch property;
- Township 38 North, Range 73 West: 32 groundwater monitoring wells drilled in conjunction with uranium mining activities at the Bear Creek site; and
- Township 38 North, Range 73 West: 6 groundwater monitoring wells drilled by the U.S. Department of Energy (DOE) in conjunction with remediation activities at the Spook nuclear site in Sections 27 and 28.

These groundwater monitoring wells range in depth from 21 to 510 feet, with an average depth of approximately 147 feet (WSEO 2011).

3.8.1.1 Fox Hills Formation Salinity Study

The Fox Hills Fm is a known water aquifer and underlies the overall project area at depths ranging from 6,769 to 6,894 feet below the ground surface. Drilling operations associated with the Proposed Action would penetrate the Fox Hills Fm, exposing the contents thereof to potential contamination from the OBM drilling fluids. Pursuant to 43 CFR 3162.5-2(D), SRC has a responsibility to "...isolate freshwater-bearing and other usable water containing 5,000 ppm or less of dissolved solids and other mineral-bearing formations and protect them from contamination...".

In an effort to comply with the regulations at 43 CFR 3162.5-2(d), SRC (in consultation with BLM) has initiated a Fox Hills Groundwater Salinity Study beginning with the Hardy Federal 24-23H well located in the SW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 23 in Township 38 North, Range 73 West. The study will use data collected from wireline logs to be run on this and other wells drilled within the HFDPA to calculate the salinity of water contained within the Fox Hills Fm based on resistivity and other log data. The results of this analysis will be used to determine what measures, if any, are needed to protect the Fox Hills Fm. Should the analysis indicate that the water contained in the Fox Hills Fm does not exceed 5,000 ppm of total dissolved solids (TDS), SRC would be required to implement measures designed to prevent the contamination of the aquifer. These measures would be incorporated into the individual APDs prior to approval. Should the analysis determine that the TDS in the aquifer exceeds the 5,000 ppm threshold, no site specific measures would be incorporated into the individual APDs for the protection thereof.

Considering that SRC is required by law to comply with the regulations at 43 CFR 3162.5-2(d), the disclosure of the Fox Hills Groundwater Salinity Study is being provided for informational purposes only and will not be discussed further in this analysis document.

3.8.2 Surface Water Resources

The project area is situated entirely within the Cheyenne River watershed. Those portions of the project area south of the Cheyenne River Divide are drained by the Dry Fork Cheyenne River, which has two primary tributaries within the project area including Brush Creek and Duck Creek. The Dry Fork Cheyenne River and its tributaries drain approximately 38,400 acres or 83.3% of the overall project area. Brush Creek flows into Duck Creek at a point located in the NE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ of Section 1 in Township 37 North, Range 72 West (within the project area) and Duck Creek subsequently flows into the Dry Fork Cheyenne River at a point located in the SE $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 28 in Township 38 North, Range 72 West (approximately three miles east of the project area boundary).

On the north/northwest side of the Cheyenne River Divide, the South Fork of Bear Creek drains approximately 7,680 acres (16.7%) of the project area. The South Fork of Bear Creek flows into

the Cheyenne River via Bear Creek, Sand Creek and Antelope Creek. The confluence of Antelope Creek with the Dry Fork Cheyenne River in the SW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 20 in Township 40 North, Range 68 West marks the beginning of the Cheyenne River proper (approximately 13.25 miles northeast of the project area boundary). All tributaries of the Cheyenne River within the overall project area are intermittent in nature and normally flow only during periods of spring runoff and/or localized periods of heavy rainfall. As indicated above, runoff generated within the project area generally flows to the northeast into the Cheyenne River via one or more of the drainages referenced above.

According to the electronic records of the WSEO (2011), there are six permitted reservoirs within the overall project area including five stock reservoirs and one settling pond operated by Sequoyah Fuels Corporation as shown in Table 3.6.

3.9 WILDLIFE

3.9.1 Big Game Species

Two big game species, pronghorn antelope (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*), inhabit the general project area. Antelope and mule deer populations residing in the area are classified within the North Converse Herd Unit, which includes antelope hunt areas 25 and 26 and deer hunt area 22. The Hornbuckle Field is specifically located within antelope hunt area 26. Herd objectives for both antelope and mule deer in the North Converse Herd Unit are 28,000 and 9,100 post hunt animals, respectively. The 2009 estimated post-season populations for the North Converse Herd Unit were 37,083 antelope and 8,328 mule deer. Antelope populations in the North Converse Herd Unit are approximately 32.5% above herd objectives, while mule deer populations are approximately 8.5% below herd objectives. There are no crucial antelope or mule deer habitats located within the Hornbuckle Field project area (WGFD 2010).

Table 3.6

Permitted Reservoirs within the Proposed Project Area ¹

Permit Number	Permit Type	Legal Location of Reservoir				Acre Feet
		Quarter	Section	Township	Range	
P5241S	Stock	SE $\frac{1}{4}$ SW $\frac{1}{4}$	31	37 North	72 West	4.47
P10498S	Stock	SE $\frac{1}{4}$ NW $\frac{1}{4}$	3	37 North	73 West	2.80
P4541S	Stock	NW $\frac{1}{4}$ NE $\frac{1}{4}$	16	37 North	73 West	19.06
P10398S	Stock	SE $\frac{1}{4}$ NE $\frac{1}{4}$	16	37 North	73 West	2.05
P10434S	Stock	SE $\frac{1}{4}$ SE $\frac{1}{4}$	16	37 North	73 West	1.84
P7806Rr	Miscellaneous	SW $\frac{1}{4}$ SW $\frac{1}{4}$	28	37 North	73 West	5.21

¹ Data gathered from the computerized records of the Wyoming State Engineer's Office: <http://seo.state.wy.us>.

3.9.2 BLM Sensitive Species

BLM sensitive species are generally those species that are in need of special management considerations. Table 3.7 contains a listing of those BLM sensitive species that may occur in Wyoming and their habitat preferences.

Table 3.7

Wyoming BLM Sensitive Species and Habitat Preferences

Species		Preferred Habitat	Likely to Occur ¹
Common Name	Scientific Name		
MAMMALS			
Long-eared Myotis	<i>Myotis evotis</i>	Conifer and deciduous forests, caves and mines	N
Fringed Myotis	<i>Myotis thysanodess</i>	Conifer forests, woodland-chaparral, caves and mines	N
Spotted Bat	<i>Euderma maculatum</i>	Cliffs over perennial water, basin-prairie shrub	N
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	Forests, basin-prairie shrub, caves and mines	N
White-tailed Prairie Dog	<i>Cynomys leucurus</i>	Basin-prairie shrub, grasslands	N
Black-tailed Prairie Dog	<i>Cynomys ludovicianus</i>	Basin-prairie shrub, grasslands	N
Swift Fox	<i>Vulpes velox</i>	Grasslands	N
Preble's Meadow Jumping Mouse	<i>Zapus hudsonicus preblei</i>	Riparian habitats along the southern Rocky Mountain front	N
BIRDS			
White-faced Ibis	<i>Plegadis chihi</i>	Marshes, wet meadows	N
Trumpeter Swan	<i>Cygnus buccinator</i>	Lakes, ponds, rivers	N
Bald eagle	<i>Haliaeetus leucocephalus</i>	Conifer and deciduous forests, trees, grasslands	N
Northern Goshawk	<i>Accipiter gentiles</i>	Conifer and deciduous forests	N
Ferruginous Hawk	<i>Buteo regalis</i>	Basin-prairie shrub, grassland, rock outcrops	Y
Peregrine Falcon	<i>Falco peregrinus</i>	Tall cliffs	N
Greater Sage-grouse	<i>Centrocercus urophasianus</i>	Basin-prairie shrub, mountain-foothill shrub	Y
Long-billed Curlew	<i>Numenius americanus</i>	Grasslands, plains, foothills, wet meadows	N
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	Open woodlands, streamside willow and alder groves	N
Burrowing Owl	<i>Athene cunicularia</i>	Grasslands, basin-prairie shrub	N
Sage Thrasher	<i>Oreoscoptes montanus</i>	Basin-prairie shrub, mountain-foothill shrub	Y
Loggerhead Shrike	<i>Lanius ludovicianus</i>	Basin-prairie shrub, mountain-foothill shrub	Y
Brewer's Sparrow	<i>Spizella breweri</i>	Basin-prairie shrub	Y
Sage sparrow	<i>Amphispiza billineata</i>	Basin-prairie shrub, mountain-foothill shrub	Y
Baird's Sparrow	<i>Ammodramus bairdii</i>	Grasslands, weedy fields	N
Mountain Plover	<i>Charadrius montanus</i>	Shortgrass, great basin-foothills grassland, and sagebrush-grasslands	N
AMPHIBIANS			
Northern Leopard Frog	<i>Rana pipiens</i>	Beaver ponds, permanent water in plains and foothills	N
PLANTS			
Laramie Columbine	<i>Aquilegia laramiensis</i>	Crevices of granite boulders and cliffs 6,400-8,000'	N
Porter's Sagebrush	<i>Artemesia porteri</i>	Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes; 5,300 to 6,500 feet	N

Table 3.7 - Continued

Wyoming BLM Sensitive Species and Habitat Preferences

Species		Preferred Habitat	Likely to Occur ¹
Common Name	Scientific Name		

PLANTS

Many-stemmed Spider Flower	<i>Cleome multicaulis</i>	Semi-moist, open saline banks of shallow ponds, lakes with Baltic rush and bulrush, 5,900 feet	N
Williams' Wafer Parsnip	<i>Cymopterus williamsii</i>	Open ridge tops & upper slopes with exposed limestone outcrops or rockslides, 6,000 to 8,300 feet	N
Laramie False Sagebrush	<i>Sphaeromeria simplex</i>	Cushion plant communities on rocky limestone ridges & gentle slopes, 7,500 to 8,600 feet	N
Limber Pine	<i>Pinus flexilis</i> James	Limber pine grows on a variety of topographies, from gently rolling terrain to cliffs. It is most often found on rocky ridges and steep rocky slopes and can survive in extremely windswept areas at both lower and upper tree line. Most often found in more open and dry environments, and is typical on exposed, rocky mountainsides. It may be found from low elevations of about 4,000 feet right up to timberline.	N

1 Key: Y = Likely to occur in or in the vicinity of the proposed project area based on habitat.
N = Not likely to occur in or in the vicinity of the proposed project area based on habitat.

BLM sensitive animal and plant species potentially occurring in the overall project area include ferruginous hawk, greater sage-grouse, sage thrasher, loggerhead shrike, Brewer's sparrow and sage sparrow. Two of these sensitive species are more likely to occur within the project area than the remaining species based upon both prior observations and a review of habitat types therein. These species include ferruginous hawk and greater sage-grouse. A brief discussion of these two individual species is presented below:

- Ferruginous hawk (*Buteo regalis*). As discussed in Section 3.9.3 below, there is little information regarding historic raptor nesting activity within the overall project area. Inventories conducted in conjunction with specific project proposals in 2009 identified two previously unknown historic ferruginous hawk nests. Past breeding activity at these historic nests is unknown.
- Greater sage-grouse (*Centrocercus urophasianus*). Greater sage-grouse populations in the general project area are included in Upland Game Bird Management Area 35 and declined throughout the Casper (WGFD) Region from the early 1980's through the mid-1990's, with this decline generally attributed to various forms of habitat degradation. Nonetheless, it would appear that sage grouse numbers in the Casper Region have increased slightly since 1996 (WGFD 2003).

There are no historic greater sage-grouse leks known to exist within the overall project area (BLM 2011) and the project area is outside of key sage grouse breeding habitat (WGFD 2011). The general project area is predominately a western mixed grass/short-grass prairie exhibiting a paucity of sagebrush habitats that would be considered as suitable nesting and brood-rearing habitat for greater sage-grouse - which is borne out by the fact that there are no known historic leks in the general area. As there are no known leks within the project area and said area is not within key habitat, there will be no significant impacts to greater sage-grouse breeding or nesting habitat. Consequently, this species will not be discussed further in this analysis document.

3.9.3 Raptor Species

There has not been a comprehensive inventory of raptor nesting activity within and/or adjacent to those lands included within the overall project area. Individual inventories have been conducted on a case-by-case basis in response to both past and present activities proposed by SRC and other operators in the area, but these inventories were generally limited to an inventory of historic nests located within a one-half mile radius of each proposed federal action. Approximately 59 historic raptor nests are known to exist within the overall project area (BLM 2011) as a result of these past inventories (BLM 2011). SRC has contracted with Hayden-Wing Associates (HWA) of Laramie, Wyoming to conduct comprehensive biological inventories within the overall project area and the results of these inventories will be reported to BLM's Authorized Officer upon completion thereof.

3.9.4 Threatened and Endangered Species

Threatened and/or endangered (T/E) species include those species which are in danger of extinction due to habitat degradation and drastic population declines and which have subsequently been listed as threatened or endangered pursuant to the *Endangered Species Act* (ESA) of 1973 (as amended). Those T/E species which may potentially occur within the general area (BLM 2006, BLM 2008a, BLM 2008b) include:

- Black-footed ferret (*Mustela nigripes*) - Status: Endangered.
- Blowout penstemon (*Penstemon haydenii*) - Status: Endangered.
- Ute ladies'-tresses (*Spiranthes diluvialis*) - Status: Threatened.
- North Platte River Species (those species which may occur in the downstream riverine habitats of the North Platte River in Nebraska and that could be adversely affected by water depletions in the North Platte River system resulting from project-related activities) including:
 - 1) Interior least tern (*Sterna antillarum*) - Status: Endangered;

- 2) Piping plover (*Charadrius melodus*) - Status: Threatened;
- 3) Pallid sturgeon (*Scaphirhynchus albus*) - Status: Endangered;
- 4) Whooping crane (*Grus americana*) - Status: Endangered; and
- 5) Western prairie fringed orchid (*Platanthera praeclara*) - Status: Threatened.

3.9.5 Migratory Bird Species

Habitats in the overall project area are primarily sagebrush-dominated uplands (shrub-steppe) with interspersed shortgrass prairie. Wyoming Partners in Flight (PIF) priority species potentially occurring in the shrub-steppe (SS) and shortgrass prairie (SGP) habitat types are listed in Table 3.9 (Nicholoff 2003).

The project area lies directly south of latitude 43°17'30"N and directly west of longitude 105°32'30"W. Species distribution as reported in *The Atlas of Birds, Mammals, Reptiles and Amphibians in Wyoming* (WGFD 1999) includes a compilation of observations mapped by latitude and longitude, with the State of Wyoming divided into 28 different regions, where these observations are reported within a specific region of the state. These regions are based upon a one degree separation of both latitude and longitude. As a consequence, the project area falls with Wyoming Distribution Area (latilongs) 13 as defined by WGFD (1999). Avian distribution data for those PIF priority species potentially occurring within the overall project area are included in Table 3.8. Only those birds that have been classified by WGFD (1999) as confirmed breeders (nest and/or young observed), with circumstantial evidence of breeding (nest and/or young not located), or that have been observed at any time (season) within the general area (but without any evidence of breeding) are included in the list. Breeding Bird Survey (BBS) data for survey routes within Wyoming were included in this database (WGFD 1999).

Most of the birds listed in Table 3.8 typically nest either on the ground or in shrubs. Potential losses are indeterminate as there are no Breeding Bird Survey (BBS) routes located within the immediate vicinity of the project area which could provide information on breeding bird densities within the shrub-steppe and shortgrass prairie habitats encountered within the overall project area. Concerns regarding the decline of both migratory and non-migratory bird populations both locally and on a continental scale have resulted in a nationwide bird conservation planning effort.

Management goals and objectives for bird conservation are found in the following documents:

- 1) Land Bird Strategic Plan;
- 2) Presidential Executive Order (EO) 13186 dated January 17, 2001; and

Table 3.8

**List of Partners In Flight (PIF) Priority Bird Species
Potentially Found Within the Hornbuckle Field Project Area**

Common Name	Scientific Name	Habitat Type	Distribution Area ¹
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Level I Species (Conservation Action)

Ferruginous Hawk	<i>Buteo regalis</i>	SS/SGP	B
Greater Sage-Grouse	<i>Centrocercus urophasianus</i>	SS	B
Mountain Plover	<i>Charadrius montanus</i>	SS/SGP	B
Upland Sandpiper	<i>Bartramia longicauda</i>	SGP	B
Long-billed Curlew	<i>Numenius Americana</i>	SGP	O
Burrowing Owl	<i>Athene cunicularia</i>	SGP	B
Short-eared Owl	<i>Asio flammeus</i>	SGP	B
Baird's Sparrow	<i>Ammodramus bairdii</i>	SGP	B
Brewer's Sparrow	<i>Spizella breweri</i>	SS	B
Sage Sparrow	<i>Amphispiza belli</i>	SS	B
McCown's Longspur	<i>Calcarius mccownii</i>	SS/SGP	B

Level II Species (Monitoring)

Black-chinned Hummingbird	<i>Archilochus alexandri</i>	SS	N
Loggerhead Shrike	<i>Lanius ludovicianus</i>	SS	B
Sage Thrasher	<i>Oreoscoptes montanus</i>	SS	B
Vesper Sparrow	<i>Pooecetes gramineus</i>	SS	B
Lark Sparrow	<i>Chondestes grammacus</i>	SS	B
Lark Bunting	<i>Calamospiza melanocorys</i>	SGP	B
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	SGP	B
Dickcissel	<i>Spiza Americana</i>	SGP	O
Bobolink	<i>Dolichonyx oryzivorus</i>	SGP	O

Level III Species (Local Interest)

Common Poorwill	<i>Phalaenoptilus nuttallii</i>	SS	B
Say's Phoebe	<i>Sayornis saya</i>	SS	B

1 Definitions for those symbols used to report Wyoming avian distribution are as follows:

B: Nest or young dependent upon parent birds observed.

b: Circumstantial evidence of breeding.

O: The species has been observed, but there was no evidence of nesting.

N: The species has not been observed in the area.

- 3) Memorandum of Understanding between the USDI BLM and USFWS to promote the conservation of migratory birds (04/12/2010).

Bird Conservation Plans prepared at the state and regional levels also include objectives for bird conservation. As evidenced by EO 13186, there has been national direction to implement actions that incorporate these goals.

3.10 ENVIRONMENTAL JUSTICE

Neither the Proposed Action nor the No Action Alternative would disproportionately affect minority or low income people, and is not discussed further in this EA. The proposed project would provide some additional employment opportunities for a small number of workers in Converse County, thereby contributing to the local economy.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

The potential environmental consequences of construction, drilling, completion, and maintenance activities associated with the Proposed Action and No Action Alternative are discussed for each potentially affected resource. An environmental impact is defined as a change in the quality or quantity of a given resource due to a modification in the existing environment resulting from project-related activities. Impacts can be beneficial or adverse; a primary (direct) result or a secondary (indirect) result of an action; long-term (more than five years) or short-term (less than five years) in duration; and can vary in degree from a slightly discernable change to a total change in the environment.

In accordance with 40 CFR 1502.16, this chapter includes a discussion of the potential environmental consequences of the Proposed Action and the No Action Alternative on each of the affected resources. Potential impacts are quantified when possible; however, when impacts are not quantifiable appropriate adjectives are used to best describe the level of impact and appropriate mitigation measures are suggested where appropriate.

4.2. AIR QUALITY

The Wyoming Department of Environmental Quality (WDEQ) operates a series of State and Local Air Monitoring Sites (SLAMS) throughout the state with the nearest SLAMS sites located in the city of Casper (approximately 42 miles southwest of the project area) and at the Antelope Coal Mine in Converse County (approximately 23 miles northeast of the project area). The Casper SLAMS site measures PM₁₀ (particulate matter less than 10 microns in size) and the Antelope Coal Mine SLAMS site monitors PM_{2.5} (particulate matter less than 2.5 microns in size) and NO_x (nitrogen oxides). A third SLAMS site in south Campbell County (approximately 75 miles north/northeast of the project area) also measures ozone (O₃) levels, in addition to PM₁₀ and NO_x. Data collected at the three referenced SLAMS sites through 2007 show that all of these monitors are in attainment with National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increment standards (WDEQ 2008).

4.2.1 Proposed Action

Construction emissions associated with the Proposed Action would include PM₁₀, SO₂, NO_x, CO, and VOCs. These emissions would result primarily from construction, drilling and completion activities, would be temporary in nature and would occur in isolation at each individual well location.

The use of Best Available Technology in the small engines to be utilized to power the generators at each individual well location would ensure the operator complies with applicable state and national ambient air quality standards. As indicated in Section 2.3.2, SRC would take

appropriate measures to minimize impacts to air quality. Non-particulate emissions would be minimized by ensuring that vehicles, rig engines, and generator, and screw compressors are maintained in proper operating condition. Watering of access roads (or the use of chemical dust suppressants) within the Hornbuckle Field Development Project Area (HFDPA) during periods of heavy vehicle traffic would also serve to reduce fugitive dust (PM₁₀) by 50% or more (BLM 2003).

Construction emissions associated with the Proposed Action would include PM₁₀, SO₂, NO_x, CO, and VOCs. These emissions would result primarily from construction, drilling and completion activities, would be temporary in nature, would occur in isolation at each proposed well location and would generate an almost undetectable level of emissions that would be limited to the near-field with no impact in the far-field (BLM 2005). As a result, emissions resulting from the construction and drilling of these proposed wells would be short-term in nature and would not have a long-term or lasting effect upon air quality or visibility within the air shed of the overall project area, northern Converse County, or the State of Wyoming.

While no air quality analyses have been conducted in this general area, analyses conducted in Natrona County, Wyoming in conjunction with environmental analyses of the Cave Gulch-Bullfrog-Waltman Natural Gas Development Project (BLM 1997), the Cooper Reservoir Natural Gas Development Project (BLM 1998), and the Wallace Creek Extension 3D Vibroseis Project (BLM 2002) concluded that no significant impacts would occur to air quality or the air shed as a result of the activities proposed in conjunction with these respective projects.

Likewise, detailed air quality modeling was conducted for Alternative A proposed in conjunction with the Desolation Flats Natural Gas Field Development Project in Carbon County, Wyoming (BLM 2004). This alternative included the drilling of 592 gas wells, the successful completion and subsequent production of 385 gas wells. The results of the modeling studies for Desolation Flats indicated that no adverse impacts to sub-grid or near-field air quality would result from the proposed project and that Alternative A of the proposed project would comply with all state and national ambient air quality standards. The air quality modeling did suggest the possibility of some contribution to far-field visibility reduction within the Class I airsheds when combined with all other human development in the analysis area (BLM 2004).

In this regard, the scope of the Samson Resources project differs considerably from Desolation Flats in well numbers (96 versus 592), well-site equipment (conventional oil/gas production versus coalbed natural gas) and compression horsepower (hp) requirements (32,000 hp versus no compression), which will result in a dramatic reduction in overall emissions associated with the proposed Hornbuckle Field Development Project as compared to the Desolation Flats Project. In lieu of compression, SRC is proposing to install 150 Kw generators on individual wells upon completion to power equipment on site (including the Ajax F18G pumping unit) pending the installation of a permanent electrical power source (see Section 2.1.4.2). The 150 Kw generators are rated at 60 hp and would be installed as stated in Section 2.1.4.2. Based on these installation estimates, approximately 33 generators would be installed on a yearly basis for three years, reaching a maximum output of 5,940 hp in year three - which represents an 81 percent reduction in overall horsepower (and associated emissions) as compared to Desolation Flats. Once the field is converted to commercial electricity provided by RMP, these emissions would cease.

4.2.2 The No Action Alternative

Under the No Action Alternative, there would be no additional impacts to ambient air quality.

4.2.3 Mitigation and Monitoring

In order to minimize the overall impact to air quality within the HFDPA which could result from additional oil/gas exploration and development activities associated with the Proposed Action, the following mitigation measures are recommended.

1. The Operator would comply with all applicable Wyoming Ambient Air Quality Standards (WAAQS) and Regulations including those for fugitive dust suppression presented in Wyoming Air Quality Standards and Regulations, Chapter 3, Section 2(f): Emission Standards for Particulate Matter (WDEQ 2010).

If a fugitive dust problem is identified by the BLM as a result of this project, immediate abatement measures (e.g., applications of water or chemical dust suppressants to disturbed surfaces) would be initiated in consultation with the BLM and WDEQ to avoid exceeding ambient air quality standards.

2. The Operator would not allow open burning of garbage or refuse at well locations or other facilities within the HFDPA. Any other open burning would be conducted under the permitting provisions of Section 13 of the Wyoming Air Quality Standards and Regulations (WDEQ 2003a).

4.3 CULTURAL RESOURCES

Cultural resources, including archaeological and historic sites, on lands subject to federal authority are protected by various laws, rules and regulations commencing with the *Antiquities Act* of 1906. Specific directives concerning Cultural Resource Management can be found in *Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines* (Federal Register 1983) and BLM Manual Section 8100.

Compliance with the National Historic Preservation Act (NHPA) is observed by following the protocol agreement between the Wyoming BLM and the State Historic Preservation Officer (SHPO) which is authorized by the National Programmatic Agreement between the BLM, the Advisory Council on Historic Preservation, the National Conference of State Historic Preservation Officers and applicable BLM handbooks. Compliance with section 106 of the NHPA takes place at the application for permit to drill (APD) stage, since it is impossible to determine the extent of surface disturbance associated with oil and gas development prior to that specific documentation. However, pipelines at all times should stay within existing disturbance areas along previously surveyed corridors as much as possible.

National Register of Historic Places (NRHP) criteria (36 CFR 60.4) for determining eligibility define four criteria of significance based upon “...the quality of significance in American history, architecture, archaeology, and culture present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association; and that:

- are associated with events that have made a significant contribution to the broad patterns of our society; or
- are associated with the lives of persons significant in our past; or
- embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or may be likely to yield, information important in prehistory or history”.

Cultural properties are generally not eligible for inclusion in the NRHP if they lack integrity, features or artifact assemblages with a potential for additional information, or structural features. Furthermore, sites that cannot be placed in a temporal context or shown to be related to other sites are usually not considered eligible and therefore are discharged from management.

4.3.1 The Proposed Action

All federally permitted activities in the HFDPA contain requirements for avoiding cultural and historic features. These permits also provide for notification of the appropriate agency and the SHPO in the event that artifacts, important features, or buried cultural deposits are discovered. As indicated in Section 3.5, Class III cultural resource inventories have been completed on approximately 5,963 acres within the proposed project area, resulting in the identification of 42 cultural sites and several isolated artifacts. Three of those sites are listed as unknown with regards to National Register eligibility and would be avoided, if possible, or else formally studied to determine their NRHP eligibility. When a specific project is planned and the BLM receives the appropriate application, a site-specific cultural records review would be conducted to determine if there is a need for further cultural inventory of areas that could be affected by surface-disturbing activities associated with the proposed action. Generally speaking, a cultural resource inventory would be required prior to any new surface disturbance in order to identify cultural resources and evaluate them for National Register eligibility. Any unanticipated discoveries of cultural resources made during future activities would be evaluated according to standard procedures, and project personnel would be prohibited from collecting any artifacts or disturbing any cultural resources in the HFDPA. As a consequence, impacts to cultural resources would likely be negligible to nonexistent.

4.3.1.1 Native American Religious Concerns

The American Indian Religious Freedom Act (AIRFA) requires Native American tribal consultation on site types previously identified as highly sensitive - which in this area would include prehistoric rock alignments, cairns, stone circles, rock art and potential funerary sites. These site types have all been recorded within the PRB and there is a potential to encounter all these site types within the proposed project area. On lands subject to federal jurisdiction, these sites are specially managed by the BLM via the use of buffer zones and any unanticipated discoveries of these sensitive site types made during future activities within the proposed HFDPA would be evaluated according to standard procedures. As a consequence, impacts to these site types would likely be negligible.

4.3.2 The No Action Alternative

Under the No Action Alternative, there would be no project-related surface disturbance and impacts to cultural resources would remain at current levels.

4.3.3 Mitigation and Monitoring

Measures for the protection of cultural resources are included in both the Multi-Point Surface Use and Operation Plan (SUP) and Conditions of Approval (COAs) for the individual APDs. These measures include, but are not necessarily limited to, the following:

1. SRC would be responsible for informing all persons associated with this project that they shall be subject to prosecution for damaging, altering, excavating or removing any archaeological, historical, or vertebrate fossil objects on-site. If archaeological, historical, or vertebrate fossil materials are discovered, the operator would suspend all operations that would further disturb such materials and immediately contact the Authorized Officer. Operations would not resume until written authorization to proceed is issued by the Authorized Officer.

Within five working days, the Authorized Officer would evaluate the discovery and inform SRC of actions that would be necessary to prevent loss of significant cultural or scientific values.

SRC would be responsible for the cost of any mitigation required by the Authorized Officer. The Authorized Officer would provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the Authorized Officer that the required mitigation has been completed, the operator would be allowed to resume operations.

2. Cultural resources of unknown National Register eligibility or those that are evaluated as eligible during future surveys would either be avoided or a Data Recovery Plan would be written and approved by the BLM and SHPO prior to any surface disturbing activities.

3. Temporary “fast lines” would be installed in existing disturbed right-of-way (ROW) locations directly adjacent and parallel to the access roads or existing pipelines wherever possible. Fast line routes would be planned in advance and submitted for approval with each individual APD to the greatest extent possible. In those cases where fast line pre-planning is not possible, line approval from a cultural resource standpoint would be handled by the BLM on a case-by-case basis.
4. Should unidentified sensitive sites of Native American concern (as defined by Executive Order 13007) be located in conjunction with project related activities, the appropriate tribes would be consulted and recommendations solicited regarding measures necessary to eliminate potential effects of the Project Action. Implementation of the following measures should ensure that there would be no impact to Native American sacred sites:
 - a) Native American sites including but not limited to cairns and stone circles would be avoided by a minimum of 300 feet or visual horizon whichever is less, unless closer activities are approved through completion of consultation with the affected tribes and written permission is given by the authorized officer.
 - b) Native American rock art sites would be avoided by a minimum of one-half mile or visual horizon whichever is less, unless closer activities are approved through completion of consultation with the affected tribes and written permission is given by the authorized officer.
 - c) Native American funerary sites would be avoided by a minimum of one mile or evaluated on a case-by-case basis for site-specific avoidance and mitigation measures. All pertinent provisions of the Native American Graves Protection and Repatriation Act (NAGPRA) and the National Historic Preservation Act (NHPA) would be applied to sites in federal jurisdiction.
 - d) If SRC personnel identify any sites of potential Native American religious concern not found during the Class III inventory, regardless of surface ownership, the BLM CFO Archeologist would be notified promptly. The BLM CFO would determine the need for special mitigation measures and/or additional Native American consultation per regulations under the NHPA or NAGPRA as needed.

4.4 RANGE MANAGEMENT

Actual construction of the individual well pads, access roads, pipelines, etc. would result in an overall reduction in livestock and wildlife forage and a subsequent reduction in the available animal unit months (AUMs) in each affected grazing allotment. For the purpose of assessing impacts to range resources, acres of disturbance were converted to a reduction in AUMs based upon an average of 3.30 acres/AUM for the HFDPA (based upon the average AUMs for the 3,755 acres of public lands administered by the BLM within the overall project area).

4.4.1 Proposed Action

The primary impact to range resources within the HFDPA would be the initial loss of vegetation and vegetative (forage) production resulting from additional oil/gas exploration and development activity. This loss of forage would reduce the amount of grazing available for domestic livestock production for each of the affected lessees and/or private surface owners. Likewise, road construction associated with the Proposed Action would impact existing range improvements and oilfield-related traffic on those roads would create dust, could result in collisions with domestic livestock, and could generally disrupt ranching activities on the affected properties.

As indicated in Section 2.1, routine activities associated with oil/gas exploration and development in the HFDPA would result in approximate surface disturbances as follows:

- 284.64 acres associated with the construction of 48 well locations;
- 109.18 acres associated with access road construction and reconstruction;
- 245.51 acres associated with installation of cross country pipelines; and
- 181.82 acres associated with the installation pipelines parallel to access roads.

Under the disturbance assumptions presented above, the initial loss of approximately 821.15 (821) acres of vegetation would result in the short-term loss of approximately 249 AUMs, which represents approximately 1.78% of the 13,963 average total AUMs (46,080 acres ÷ 3.30 average AUMs) available on surface lands within the HFDPA. Reclamation of those areas not required for ongoing production and operations would place approximately 457 acres back into forage production within 1 to 2 years following the initial disturbance. Reclamation of these areas would result in a long term loss of 109 AUMs, which represents less than one (0.78) percent of the total average AUMs available on surface lands within the project area.

The disturbance of existing, native vegetation would create opportunities for the establishment of invasive, non-native (invasive) species. Invasive species are easily established and commonly found on all newly disturbed and reclaimed sites throughout Wyoming. These species are fast growing, can out-compete native species, can increase the danger of wildfires, and can prevent the establishment of native species including grasses, forbs and, and shrubs.

Several species of invasive plant species have become established on disturbed sites throughout central Wyoming including, but not necessarily limited to, Canada thistle (*Cirsium arvense*), cheatgrass (*Bromus tectorum*), halogeton (*Halogeton glomeratus*), musk thistle (*Carduus nutans*) and Russian knapweed (*Centaurea repens*) and the ongoing drought conditions experienced in central Wyoming over the past several years would appear to have exacerbated the proliferation of these invasive species on recently reclaimed areas. If allowed to become established, infestations of these invasive species could provide seed sources for the invasion of adjacent, neighboring lands and could impact forage production on these affected lands for both domestic livestock and wildlife.

Invasion of disturbed areas by any of the species identified in 3.6.2 would affect native forage production, thereby reducing the available AUMs within the affected areas. However, surface disturbances associated with the proposed project area would affect less than two percent of the combined surface acreage within the overall HFDPA. Successful interim reclamation of the initial surface disturbance associated with the Proposed Action would further reduce the areas potentially subject to invasion by non-native and noxious weed species.

In this regard, agreements negotiated between SRC and the affected private surface owners for access to and construction of the proposed roads, well locations, pipelines, etc. would provide for compensation to these owners for the surface disturbances associated with the Proposed Action thereby offsetting these impacts. These agreements typically also include operational provisions designed to mitigate impacts to existing range improvements, livestock losses resulting from operations, noxious weed invasion, etc. that may adversely affect their respective ranching activities.

4.4.2 The No Action Alternative

Under the No Action Alternative there would be no further loss of vegetation with a concomitant reduction in available AUMs. Likewise, the invasion of disturbed areas by non-native species would be restricted to areas previously disturbed in conjunction with prior approvals.

4.4.3 Mitigation and Monitoring

In order to minimize the overall impact to range resources within the HFDPA which could result from additional oil/gas exploration and development activities associated with the Proposed Action, the following mitigation measures are recommended.

1. Removal or disturbance of vegetation would be kept to a minimum through construction site management (e.g., by utilizing previously disturbed areas, using existing ROWs, designating limited equipment/material storage yards and staging areas, scalping, etc.).
2. The Operator would seed and stabilize disturbed areas in accordance with management direction from the Authorized Officer, BLM.
3. The Operator would monitor for noxious and invasive weed species and would apply BLM-approved weed control techniques (e.g., soil sterilants, biological controls, etc.) as necessary to control infestations with the prior approval of the Authorized Officer, BLM.
4. The Operator would fence all open pits as deemed necessary by and in accordance with management direction received from both the Authorized Officer, BLM and the affected private surface owner.

4.5 SOILS

Removal of native vegetation and disturbance of the underlying soil material as a result of surface disturbing activities associated with the Proposed Action would increase the potential for loss of the existing soil resource through erosion. This potential would increase proportionately as degree of slope increases. Overall, soils within the overall project area generally have an adequate amount of topsoil available to ensure satisfactory reclamation, assuming the use of proper techniques designed to control erosion and ensure revegetation of the reclaimed areas are utilized in the reclamation process and slopes throughout the project area are relatively gentle. Additional oil/gas exploration and development activity within the HFDPA would result in the initial disturbance of approximately 821 acres of the soil resource, or less than four percent of the total surface estate included within the proposed project area.

4.5.1 The Proposed Action

As stated in Section 4.4.1, additional oil/gas exploration and development activity within the HFDPA would result in the initial disturbance of approximately 821 acres of the soil resource, or less than two percent of the total surface estate included within the proposed project area.

Impacts that could result from surface disturbing activities associated with the Proposed Action would include the removal of vegetation, subsequent exposure and disturbance of the soil, mixing of soil horizons, an increase in the susceptibility of the soil to wind/water erosion, loss of the soil resource, and a long-term alteration in the topography of the affected areas(s). The initial disturbance of the soil, in association with the potential loss of soil through erosion, could ultimately reduce both the quantity and productivity of topsoil available for reclamation operations. However, all available topsoil would be salvaged during initial construction and stockpiled for later revegetation in order to assure that the natural fertility and reclamation potential of the topsoil resource is not reduced.

Increased surface runoff and water erosion would primarily occur in the short-term and would decline over time due to natural stabilization and surface crusting. Soil and climatic factors in the overall area, combined with utilization of technological and/or mechanical applications designed to enhance revegetation would generally ensure stabilization of each disturbed area within one to two years after initial disturbance.

A detailed analysis of projected soil erosion rates was conducted for the *Cave Gulch-Bullfrog-Waltman Natural Gas Development Project* (BLM 1997). The Modified Soil Loss Equation (MSLE) was used to calculate soil erosion, and erosion rates were determined based on general assumptions of conditions and operating procedures for the comparison of alternatives. These calculations suggest that soil erosion can be reduced significantly with the application of Best Management Practices (BMP) as referenced in BLM Instruction Memorandum 2004-124 (www.blm.gov/bmp) and the joint BLM/U.S. Forest Service (USFS) publication: *Surface Operating Standards for Oil and Gas Exploration and Development* (Fourth Edition). Table 4.1 provides estimated erosion rates based upon the 1997 Cave Gulch analysis.

Table 4.1

Estimated Erosion Rates per Acre of Surface Disturbance Calculated Both With and Without the Application of Best Management Practices in Tons/Acre/Year

Type of Disturbance	Bare Soil Surface - BMP Not Applied	BMP Applied - Erosion After One Year	BMP Applied - Erosion After Five Years
Individual Well Pads	13.8 tons/acre/year	1.5 tons/acre/year	0.2 tons/acre/year
Access Roads	5.8 tons/acre/year	2.3 tons/acre/year	0.5 tons/acre/year

Source: Soils, Water, and Vegetation Resources Technical Report. Report prepared for the *Cave Gulch-Bullfrog-Waltman Natural Gas Development Project EIS* (Grah 1997).

As demonstrated above, implementation of BMP for reclamation and erosion control would result in a 95% reduction in erosion in the first year and a 96% reduction in erosion by the fifth year, with implementation of BMP resulting in an overall 99% reduction in erosion after five years. These analyses suggest that soil erosion resulting from the Proposed Action could be significantly reduced with the application of BMP for reclamation and stabilization of disturbed soils (BLM 1997, BLM 2003, Grah 1997). Soil characteristics in HFDPA were compared with soil characteristics in the Cave Gulch-Bullfrog-Waltman Natural Gas Development Project area (BLM 1997) and were generally found to be similar in terms of soil attributes and erosion factors.

The initial disturbance of approximately 821 acres of the soil resource is not considered as a major impact thereto. As discussed above, successful implementation of BMP in the reclamation of surface disturbance associated with this project should reduce erosion by 99% after five years.

4.5.2 The No Action Alternative

Under the No Action Alternative there would be no project-related disturbance of soils and soils would remain in their current state.

4.5.3 Mitigation and Monitoring

In order to minimize the overall impact to soil resources within the HFDPA which could result from surface disturbing activities associated with the Proposed Action, the following mitigation measures are recommended.

1. Construction and/or surface disturbing activities would be prohibited during periods when the soil material is saturated, frozen, or when watershed damage is likely to occur.

2. All available topsoil (e.g., 6 to 12 inches) should be removed (stripped) from areas of new construction and stockpiled for future reclamation of these disturbed areas. This stored topsoil, as well as cut and fill slopes on the well pad, should be secured from erosion through mulching and temporary revegetation if reclamation is not anticipated within one year following initial construction.
3. Unused areas (borrow ditch) along the proposed access road route(s) which would be denuded of existing vegetation during initial construction should be reseeded in order to re-establish vegetative cover and reduce the overall potential for erosion and off-site sedimentation.
4. Sandy soils which are prone to wind and water erosion should be uniformly mulched with certified weed-free native grass, hay, or small grain straw at a rate of two tons/acre. Cotton, jute, or synthetic netting may be applied in steep areas where erosion would be a problem as required by the Authorized Officer in consultation with the affected private surface owner. Mulch would be crimped two to four inches into the soil on the contour, tackified, or incorporated into erosion control blankets to prevent it from blowing or washing away and from entering waterways. Mulch would protect the soil from wind and water erosion, raindrop impact, and surface runoff, and would help hold seeds in place. Mulching may occur prior to or after broadcast seeding but must not occur before drill seeding.

Hydromulch, biodegradable erosion control netting, or matting would be firmly attached to the soil surface on steep slopes where it is unsafe to operate equipment, at sites where soils have 35% or more surface rock content, or on notably unstable areas.

5. All reclaimed surfaces would be left rough and would be mulched as described above to reduce the potential for wind and water erosion. Erosion and sediment control structures would be installed on reclaimed areas wherever slopes exceed 3:1. Runoff from reclaimed areas on hillsides with 3:1 or greater slopes would be controlled using standard structures including, but not limited to, waterbars, silt fences, geotextile, and/or energy dissipaters. Waterbars would be installed in accordance with standard BLM specifications and would drain into undisturbed vegetation as follows:
 - a) Prior to commencement of reseeding activities, waterbars would be constructed at least one foot deep, on the contour with approximately two feet of drop per one hundred feet of waterbar to ensure drainage, and extended into established vegetation. All waterbars would be constructed with the berm on the downhill side to prevent the soft material from silting in the trench. The initial waterbar should be constructed at the top of the backslope. Subsequent waterbars should follow the following general spacing guidelines contained in Table 4.2.
 - b) Silt fences, if/as necessary, would be placed downslope from reclaimed areas where erosion may impact a water body, and would be installed according to manufacturers' instructions. Energy dissipaters would be used to slow flows wherever water is channelized (e.g., by a waterbar or an interceptor ditch). All runoff and erosion control structures would be inspected and maintained by SRC on a regular basis until the site is determined to be stable.

Table 4.2

General Waterbar Spacing Guidelines

% Slope	Spacing Interval (feet)
2% or <	200'
2% - 4%	100'
4% - 5%	75'
5% or >	50'

It should be noted that some of the mitigation measures recommended above may be included in the Multi-Point Surface Use and Operation Plan (SUP) prepared for each well by SRC, while others may be included in Lease Notice #1 appended to the approved oil/gas lease(s). Those mitigation measures not included in either the SUP or Lease Notice #1 will be applied as Conditions of Approval to the individual APDs as necessary to minimize impacts to the soil resource.

4.6 WATER RESOURCES

Hydrologic impacts resulting from surface disturbances associated with the proposed project would include the removal of vegetation, exposure of the underlying soil surface, and compaction of the soil. These impacts would result in an increased overland flow of surface runoff with subsequent erosion and off-site sedimentation. Consequently, these changes in the local environment could create the potential for increased stream flow, increased sediment loading and the subsequent degradation of both surface and subsurface water quality below acceptable standards if they are not properly controlled or occur in close proximity to a perennial stream or aquifer recharge point. Both the magnitude and duration of these impacts depend upon several factors, including:

- slope aspect and gradient,
- degree and extent of soil disturbance(s),
- susceptibility of the soil to erosion,
- proximity of the disturbance to existing stream channels, and
- mitigation measures implemented.

Additional factors would include the duration of construction (surface disturbing) activities coupled with the timely implementation and subsequent success (or failure) of applicable

reclamation measures. These potential impacts would be greatest after commencement of construction activities, but would begin to decrease shortly after completion of surface disturbing activities due to a combination of passive stabilization and implementation of erosion and sediment control measures as necessary to control runoff.

The leakage or spillage of liquid hydrocarbons and/or other fluids/chemicals utilized in quarry operations could also degrade both surface and ground water resources. The impact of such an occurrence would depend primarily upon the quantity and chemical composition of the fluid(s) released, the relative proximity of the spill to the water body potentially impacted, and mitigation measures implemented to control the event.

4.6.1 Ground Water Resources

As stated in Section 3.6.1, a review of the electronic records of the office of the Wyoming State Engineer (WSEO) revealed that there are approximately 46 permitted water wells within the overall project area.

The average depth of these water wells is 344 feet, with actual depths ranging from a minimum of 44 feet to a maximum depth of 1,000 feet. As stated in Section 2.1.2.2, SRC intends to drill the surface hole with a fresh water mud system and then set approximately 2,000 feet of steel surface casing, which would be cemented in place from top to bottom, thereby preventing any potential communication between and/or cross-contamination of the near surface water aquifers in the project area. The use of a fresh water mud system to drill the surface hole would eliminate any potential for contamination of near surface water aquifers from the oil-based mud system utilized for drilling operations below 2,000 feet.

The potential for the contamination of near-surface water aquifers from the use of OBM in the mud system has been eliminated through the techniques outlined in Section 2.1.2.1 which includes the use of a semi-closed mud system during the actual drilling operation combined with recycling of the OBM fluids and the solidification of the “contaminated” cuttings upon completion of operations. In those rare instances where ground water may be encountered within twenty feet of the surface, SRC would drill a test hole on the well location to determine the depth to ground water. Should ground water be encountered within twenty feet of the surface in the test hole, a closed mud system would be used during the drilling operation to prevent any shallow ground water contamination in accordance with Chapter 1, Section 2(n) and Chapter 4, Section 1(j) of the rules and regulations of the WOGCC (WOGCC 2010).

4.6.2 Surface Water Resources

The 829 acres of short-term surface disturbance within the HFDPA would occur in the watershed of the Cheyenne River as discussed in Section 3.6.2. The potential for off-site erosion and sedimentation throughout the HFDPA would be reduced through the implementation of Best Management Practices (BMP) in the construction and subsequent reclamation of surface disturbances. These reclamation techniques would be augmented on an as-needed basis through

the incorporation of site specific reclamation requirements directly into the conditions of approval for those actions proposed in conjunction with the Proposed Action requiring federal authorization. Typically, these reclamation requirements would be developed during the permit review process (on-site inspection) and would be based upon site-specific concerns identified during the course thereof. Consequently, the potential for increased erosion and sedimentation within or directly adjacent to the HFDPA is considered to be negligible when one considers the following:

- 1) the total amount of surface disturbance which would result over the LOP from additional oil/gas exploration and development activity within the HFDPA (829 acres of short-term disturbance) represents only 1.8 percent of the total land area included within the overall project area;
- 2) successful reclamation of disturbed areas not required for on-going production operations (652 acres) would result in an approximate 79% overall reduction in long-term or LOP surface disturbance, thereby further reducing the potential for erosion and off-site sedimentation (LOP disturbance for the HFDPA = 177 acres); and
- 3) the implementation of site specific “Best Management” reclamation practices designed to stabilize disturbed areas as quickly as possible, would result in a 94% overall reduction in erosion after the first year and a 95% reduction in erosion after five years (refer to Section 4.5.1).

Considering that there are no perennial (flowing) streams within the overall project area, there is a limited potential for surface water contamination as a result of operations associated with the Proposed Action. Construction and reclamation techniques outlined in Chapter 2 combined with any Conditions of Approval (COAs) applied to individual permit approvals would minimize the potential impact to surface water resources and resultant water quality resulting from oil/gas exploration activities associated with the Proposed Action. As a consequence, we do not anticipate any adverse impacts to surface water quality as a result of the Proposed Action.

4.6.3 The No Action Alternative

Under the No Action Alternative, no additional oil/gas exploration and development activities would occur and impacts to surface and ground water resources within the overall project area would continue at current rates without the added impacts resulting from the activities associated with the Proposed Action.

4.6.4 Mitigation and Monitoring

In order to minimize the overall impact to water resources within the HFDPA which could result from surface disturbing activities associated with the Proposed Action, the following mitigation measures are recommended.

1. Construction at drainage crossings would be limited to periods of low or no-flow.
2. The Operator would follow all practical alternatives and designs to limit disturbance within drainage channels, including ephemeral and intermittent draws.
3. A 100 foot wide buffer area of undisturbed land would be left between proposed well locations and ephemeral and intermittent channels.
4. Channel crossings by pipelines would be constructed so that the pipe is buried at least 4 feet below the channel bottom.
5. Channel crossings by roads and pipelines would be constructed perpendicular to flow and would not run parallel to ephemeral and intermittent channels.
6. Disturbed channel beds would be reshaped to their approximate original configuration.
7. All cuttings pits would be constructed with 100% of the total depth of the pit below the finished grade of the well location. Pit volumes would be calculated to allow for a minimum of four (4) feet of overburden on the solidified cuttings upon pit closure.
8. All cuttings and frac water pits would be designed with a minimum of two (2) feet of freeboard.
9. The discharge of all water (storm water, produced water, etc.) would be done in conformance with applicable WDEQ, BLM and WOGCC rules and regulations.

4.7 WILDLIFE

Impacts on local wildlife populations would result from direct removal or alteration of habitat, increased human presence associated with additional oil/gas exploration and development activities, and direct wildlife/human interaction. Activities associated with additional exploration and/or development activity within the HFDPA would temporarily eliminate approximately 821 acres of wildlife habitat, consisting mostly of grasses and forbs. This would result in a proportionate reduction in the amount of herbaceous and browse forage available to herbivorous species such as antelope and mule deer, as well as a reduction in nesting, feeding and security habitat for migratory birds and those smaller vertebrate species that may inhabit the affected areas. These habitat losses can generally be classified as being either short-term or long-term in duration, with these terms defined below.

- Short-term loss refers to disturbances that would be reclaimed immediately after exploration and/or development activities are completed. Loss or alteration of habitats in grass-shrub meadows and/or on grassy slopes would be considered short-term and are expected to occur in conjunction with lease development.

- Long-term loss would occur in areas that could not be returned to their original vegetative state within a reasonable period of time (three to five years), such as producing well sites and access roads.

4.7.1 The Proposed Action

The removal of 821 acres of wildlife habitat in the short-term and 177 acres in the long-term would have a negligible impact on wildlife populations due to the small area(s) affected and the relative availability of similar, undisturbed habitats in directly adjacent areas. Upon conclusion of operations within the HFDPA and once successful reclamation of these disturbed areas has been achieved, these affected habitats would ultimately return to pre-project conditions.

4.7.1.1 Big Game Species

As stated in Section 3.9.1, there are no crucial big game habitats within the HFDPA. Rather than direct habitat loss, the greatest impact on wildlife populations would be from displacement of big game species from preferred habitats as a result of increased level(s) of human activity (including vehicular traffic) and associated noise. The extent of this displacement is difficult to predict when one considers that response to noise and human presence varies from species to species as well as among individuals of the same species. In some cases, wildlife species may habituate to noise and human presence after initial exposure, and begin to utilize areas that were formerly avoided. Numerous studies have examined the effects of human presence on big game species (Klein 1974; Irwin and Peek 1979; Ward and Cupal 1979; MacArthur et al. 1982; Brekke 1985) and it is commonly presumed that these effects are detrimental to individual species. However, research on the relationship between displacement from preferred habitats and increased stress due to human harassment (both intentional and otherwise) on overall population dynamics has been inconclusive to date, particularly pertaining to oil/gas exploration and development activity.

In addition to the avoidance response, an increased human presence intensifies the potential for wildlife-human interactions ranging from the harassment of wildlife to poaching and increased legal harvest. Likewise, increased traffic levels on existing access roads could increase the potential for wildlife-vehicle collisions. These collisions are most frequent where roads traverse areas commonly frequented by game species.

Generally speaking, construction, drilling and completion activities within the HFDPA would temporarily displace big game animals in the immediate vicinity (up to 0.5 miles) of such activities. However, once these intensive activities have been completed, most big game animals would become acclimated to the reduction in traffic and human activity and would continue to utilize suitable habitat in closer proximity to well pads and access road routes. However, such habitat may not be utilized to the same extent as it was prior to disturbance. It could take 10 to 20 years for some reclaimed areas to attain pre-disturbance shrub conditions and vegetation diversity. However, once all production operations have been terminated, existing facilities abandoned and removed, reclamation and reseeding operations completed, and suitable

vegetation has been re-established, big game animals would likely re-occupy all previously disturbed areas within the project area.

4.7.1.2 BLM Sensitive Species

As stated in Section 3.9.2, there are no greater sage-grouse leks known to exist within the HFDPA and this area is outside of identified greater sage-grouse key habitat. As a consequence, it is unlikely that the Proposed Action would have an adverse impact upon greater sage-grouse populations or their habitat within the project area.

The potential impacts of the Proposed Action to ferruginous hawks will be discussed in Section 4.7.1.3.

4.7.1.3 Raptor Species

Surface disturbance and concomitant human intrusion(s) associated with additional oil/gas exploration and development activity within the HFDPA could have a negative effect upon raptor breeding and/or nesting activities within the overall project area if these activities were allowed to proceed during the breeding/nesting season. Likewise workover/recompletion activities proposed during critical time periods in the breeding/nesting cycle could result in aborted breeding activity and/or nest abandonment.

As stated in Section 3.9.3, approximately 59 historic raptor nests are known to exist within the overall project area. Unfortunately, there is no definitive data on the particular raptor species associated with these historic nests or the annual use thereof. Based on the habitat types found within the HFDPA, it would be reasonable to assume that these nests would most likely be associated with the following raptor species:

- Ferruginous hawk (*Buteo regalis*);
- Golden eagle (*Aquila chrysaetos*);
- Great horned owl (*Bubo virginianus*); and
- Red-tailed hawk (*Buteo jamaicensis*).

4.7.1.4 Threatened and Endangered Species

A search was made of the Wyoming Natural Diversity Database (WYNDD) in 2009 to determine if sightings for any of the T/E species discussed in Section 3.9.4 have been recorded within Townships 37 and 38 North, Range 73 West. The WYNDD contained no sightings for these species in the selected townships and ranges (WYNDD 2009).

Those federally-listed species that may occur in the project area were identified in Section 3.9.4 and include the black-footed ferret and Ute ladies'-tresses as well as five species found downstream in the North Platte River drainage that could be affected by water depletions there from (BLM 2006, BLM 2008a, BLM 2008b, BLM 2009). Table 4.3 provides a listing of these species and their potential occurrence within the HFDPA. Following is a brief discussion of each species including their habitat preferences and potential for occurrence in the project area.

Table 4.3

Federally Listed Threatened and Endangered Species and Their Potential Occurrence within the Hornbuckle Field Development Project Area

Common Name	Scientific Name	Federal Status ¹	Potential Occurrence Within the HFDPA ²
MAMMALS			
Black-footed ferret	<i>Mustela nigripes</i>	E	X
BIRDS			
Interior least tern ³	<i>Sterna antillarum</i>	E	X
Piping plover ³	<i>Charadrius melodius</i>	T	X
Whooping crane ³	<i>Grus americana</i>	E	X
FISH			
Pallid sturgeon ³	<i>Scaphirhynchus albus</i>	E	X
PLANTS			
Blowout penstemon	<i>Penstemon haydenii</i>	E	X
Ute ladies'-tresses	<i>Spiranthes diluvialis</i>	T	X
Western prairie fringed orchid ³	<i>Plantanthera praeclara</i>	T	X

¹ Federal status: E = listed as federally endangered.
T = listed as federally threatened.

² Species occurrence:

- O = occasional; this species may occur in the HQPA during specific times of the year and may be locally common when suitable food is available; generally not present for extended periods.
- R = rare; species may occur in the HQPA for just a few days or hours (e.g., stopping over during migration), or the species has only occasionally or rarely been sighted in the HQPA. Encounters during the proposed action are very unlikely.
- X = unlikely; there has been no recent historical record of the species' occurrence in the HQPA; probability of encountering the species during project-related activity is very unlikely.

³ North Platte River species.

- Black-footed ferret (*Mustela nigripes*). The black-footed ferret is a potential resident in prairie dog (*Cynomys sp.*) colonies throughout the State of Wyoming with a re-introduced

population in the Shirley Basin area of northeastern Carbon County, Wyoming. There are no known prairie dog towns within the HFDPA and recent inventories by HWA have not identified any prairie dog towns within the inventory area; consequently, impacts to black-footed ferrets will not occur.

- Blowout penstemon (*Penstemon haydenii*). Blowout penstemon is a potential resident in “blowouts” - sparsely vegetated depressions in active sand dunes created by wind erosion which typically form on windward sandy slopes where the vegetation has been removed or disturbed (Fertig 2000a). In Wyoming, the only known populations of blowout penstemon are located at the eastern end of the Ferris sand dune system at the head of Schoolhouse Creek and on the west side of Bradley Peak in Carbon County (BLM 2003).

As there are no active sand dunes known to exist within the HFDPA, this species is not expected to occur within the overall project area.

- Ute ladies'-tresses (*Spiranthes diluvialis*). Ute ladies'-tresses is a perennial orchid that occurs primarily on moist, sub-irrigated or seasonally flooded soils in valley bottoms, gravel bars, old oxbows, or floodplains bordering springs, lakes, rivers, or perennial streams at elevations between 1,800 and 6,800 feet (Fertig 2000b; Keinath et al. 2003; Spackman et al. 1997). Where Ute ladies'-tresses occur in ephemeral drainages, groundwater is typically shallow (i.e., within approximately 18 inches of the ground surface) (BLM 2005).

In Wyoming, *S. diluvialis* is known from Converse, Goshen, Laramie and Niobrara Counties in the Antelope Creek, Horse Creek and Niobrara River watersheds (Fertig 2000b, Heidel 2007). Nine occurrences of the species have been recorded in Wyoming, with the closest recorded occurrence of *S. diluvialis* to the project area recorded in northwestern Converse County approximately 2.75 miles to the northwest thereof (Heidel 2007, WYNDD 2009).

Although there are no perennial streams with associated riparian habitats as discussed above within the HFDPA, potential *S. diluvialis* habitat is believed to occur along selected stretches of several drainages within the HFDPA including North and South Forks of Bear Creek, Brown Spring Creek, Dry Fork Cheyenne River, Duck Creek, Ray Draw and Willow Creek (BLM 2011). SRC has scheduled inventories of these drainages in 2011 to determine the presence/absence of *S. diluvialis*. Surface disturbing activities associated with the Proposed Action in those areas where populations of *S. diluvialis* are identified would be avoided.

- North Platte River Species. Those five North Platte species identified in Section 3.9.4 (including interior least tern, piping plover, pallid sturgeon, whooping crane and western prairie fringed orchid) that may occur in the downstream riverine habitats of the North Platte River in Nebraska could be adversely affected by surface water depletions (consumption) in the North Platte River system resulting from project-related activities. As stated in Section 2.1.2.1, water to be used in drilling operations would be obtained from local sources not connected to the North Platte River. As a consequence, no depletions would result in the North Platte River system and the downstream riverine habitats of these species would not be affected by the Proposed Action.

4.7.1.5 Migratory Bird Species

As previously discussed, surface disturbing activities associated with the Proposed Action would result in the initial disturbance of approximately 821 acres of western mixed grass/short-grass prairie which provides a source of food, security cover and nesting habitat for many of the species listed in Table 3.9. Approximately 79% of this disturbance would be reclaimed within five years of initial disturbance resulting in a long-term (LOP) loss of approximately 177 acres of habitat.

Considering the relatively small percentage of total surface disturbance proposed within the HFDPA as compared to the overall project area, the actual magnitude of direct habitat loss and subsequent displacement would be minimal. The displacement of bird species to adjacent, undisturbed habitats, while difficult to predict, would be relatively short-term in nature given the overall duration of activities associated with the proposed horizontal drilling project.

4.7.2 The No Action Alternative

Under the No Action Alternative impacts to wildlife populations in the area would continue at existing levels without the additional impacts arising from implementation of the Proposed Action.

4.7.3 Mitigation and Monitoring

In order to minimize the overall impacts to wildlife within the HFDPA which could result from additional oil/gas exploration and development activities associated with the Proposed Action, the following mitigation measures are recommended.

1. To protect important raptor nesting habitat, drilling and/or surface use will not be allowed within one-half mile of occupied raptor nests during the period from February 1 to July 31.
2. Overhead power lines will be designed, constructed and installed in accordance with the standards outlined in *Suggested Practices for Raptor Protection on Power Lines: the State of the Art in 2006* (APLIC 2006).
3. Areas known or suspected to contain essential habitat for special status plant species will be subject to a controlled use restriction requiring the Operator to conduct inventories or surveys to verify the presence or absence of special status species.
4. The Operator would implement policies designed to control poaching and littering and would notify all employees (contract and company) that conviction of a major game violation could result in disciplinary action. Contractors would be informed that any intentional poaching or littering within the HFDPA could result in dismissal.

4.8 CUMULATIVE IMPACTS

Cumulative impacts are impacts which are likely to occur due to the proposed action in combination with other ongoing activities including recently constructed projects in the area and/or projects which would likely be implemented in the area in the near future. Pursuant to NEPA, the BLM must consider the cumulative impacts of the Proposed Action in conjunction with other ongoing oil/gas exploration activities within the general area. In addition, unrelated activities within the overall project area which might have an adverse impact upon existing natural resources in the area and, consequently, which would further contribute to the overall degradation of the human environment must be considered in the analysis of cumulative impacts as well.

4.8.1 Introduction

As stated in Section 3.4, approximately 107 oil/gas wells have been drilled in within the HFDPA, with 38 of these wells subsequently plugged and abandoned. For the purposes of this environmental analysis, we will assume that these 38 wells have been successfully reclaimed and no longer represent long-term surface disturbance within the HFDPA, while the remaining 69 wells either are or will shortly be producing and thus represent a cumulative, long-term impact upon the human environment.

Using these assumptions, the surface disturbance within the overall HFDPA resulting from previous oil/gas exploration and development activities as well as oil/gas activities associated with ongoing activities within the HFDPA not subject to federal jurisdiction is quantified as follows:

- 2.16 acres of short term disturbance (1.81 acres long-term) associated with the installation of an SRC field office on private surface estate within the Hornbuckle Field (see Section 2.1.8).
- 4.61 acres of long term disturbance associated with the installation of a storage yard on private surface estate within the Hornbuckle Field (see Section 2.1.8).
- 144.94 acres of long term disturbance for the 69 producing wells. These disturbance figures are based on the assumptions for initial well pad construction and interim reclamation following completion activities referenced in Sections 2.1.1.2 and 2.15 respectively. Considering that many of these existing wells were drilled as vertical well with no provision for multiple wells from a single well pad, the acreages estimated for 54 of these existing wells is probably exaggerated. Surface disturbance resulting from the installation of pipelines and power lines associated with these 69 wells is considered as short-term in nature and does not represent a cumulative impact as most of this disturbance has already been reclaimed.
- 268.39 acres of long term surface disturbance associated with 79.08 miles of existing road within the project area. Existing surface disturbance within the overall HFDPA attributable to the existing road network (including all bladed roads) is based on the assumption that the

outslope and borrow ditch areas of these roads have already been reseeded resulting in an average disturbed ROW width of 28 feet following interim reclamation.

- 424.24 acres of short-term disturbance associated with the installation of approximately 100 miles of buried pipeline within the project area. Of this total disturbance, approximately 242.42 acres would be attributable to the installation of approximately 211,200 feet of pipeline in a 50 foot ROW cross-country, and the remaining 181.81 acres would be attributable to the installation of approximately 316,800 feet of pipeline parallel to existing roads and installed in a 25 foot ROW.
- 11.48 acres of short term surface disturbance associated with the eight inch trunk line referenced in Section 2.1.4.1, with 3.09 acres attributed to the installation of the line across federal surface estate and the remaining 8.39 acres attributed to the installation of the line across approximately 7,310 feet of private (fee) surface estate. The disturbance calculations were based on a 50 foot disturbed ROW width for installation of the buried pipeline.

In addition to the previous oil/gas activity within the HFDPA, the area has also seen surface disturbance related to uranium mining activities as follows:

- 1,047 acres of long term disturbance associated with the Bear Creek open pit uranium mine. The Bear Creek facility was operated as a series of open pit mines with associated facilities that originally encompassed 8,000 acres within Township 38 North, Range 73 West. The uranium mine and mill (which includes the Spook site discussed in Sections 1.2 and 3.8.1) operated from 1977 until 1986 when falling prices for yellow cake rendered the operation unprofitable. Through a series of acquisitions, Anadarko Petroleum Corporation subsequently acquired the rights to the Bear Creek acreage and is currently in the process of decommissioning the mine. Reclamation of the Bear Creek uranium mill was completed in 1999 (Spook site) and the Nuclear Regulatory Commission (NRC) concurred that the reclamation of the mill facility and tailings impoundment was complete in 2001 (DOE 2011, WMA 2011). The mine permit area has subsequently been reduced from 8,000 acres to 1,047 acres (WMA 2011).

From the extant data on the Bear Creek uranium mine, it would appear that most long-term surface disturbance associated with the operation had been reclaimed by the turn of the 21st century and that much of that reclamation has since been approved by the appropriate regulatory authorities. However, for the purposes of this document, we will assume that the remaining 1,047 acres referenced above does represent a long-term disturbance and will be included in the calculations of cumulative surface disturbance within the HFDPA and while this is probably an inflated disturbance figure, this is the best available information on remaining surface disturbance within the original mine permit area.

- 34.9 acres of short term surface disturbance (9.04 acres long term) associated with the Power Resources, Inc./Cameco Resources Reynolds Ranch in-situ uranium mining proposal. Cameco has applied to the NRC and the Wyoming Department of Environmental Quality (WDEQ) for approval to expand their Smith Ranch-Highland mining operation in Townships 36 and 37 North, Ranges 73 and 74 West. The overall Reynolds Ranch In-Situ Leaching

(ISL) project encompasses a mine permit area of approximately 8,280 acres, with approximately 1,200 acres of this permit area included within the HFDPA in Sections 30-32 of Township 37 North, Range 73 West. Of the 1,200 acres included within the HFDPA, 40 surface/mineral acres are in federal ownership, 800 acres are fee surface/federal mineral (split) estate, with the remaining 360 acres of surface/mineral estate in private ownership (BLM 2010). From the information contained in Section 3.8.1, we know that Cameco has drilled 17 ground water monitoring wells within that portion of the mine permit area located within the HFDPA, but it is unclear if actual ISL operations have commenced therein at this point in time.

The surface disturbances discussed above are summarized in Table 4.4. There are no other projects currently proposed or planned in the reasonably foreseeable future within or directly adjacent to the overall project area that would contribute to the impacts of those facilities proposed within the HFDPA and summarized in Table 4.4

Table 4.4

Compilation of Proposed and Existing Surface Disturbance in the HFDPA

Source(s) of Disturbance	Disturbance in Acres	
Components of Proposed Action Subject to Analysis	Short Term	Long Term
New Well Locations	284.64	100.80
Proposed Access Road	109.18	76.43
Proposed Pipelines: 25' ROW Width	181.82	0.00
Proposed Pipelines: 50' ROW Width	242.42	0.00
Eight Inch Trunk Line Crossing BLM Surface Estate	3.09	0.00
Sub-Total	821.15	177.23
Source(s) of Disturbance	Disturbance in Acres	
Cumulative Additions to Proposed Action	Short Term	Long Term
SRC Office in Hornbuckle Field on Fee Surface Estate	2.16	1.81
SRC Storage Yard in Hornbuckle Field on Fee Surface Estate	0.00	4.61
Eight Inch Trunk Line Crossing Fee Surface Estate	8.39	0.00
Drilling/Producing Wells Existing Prior to HFDPA Analysis	0.00	144.94
Existing Access Roads within the HFDPA	0.00	268.39
Bear Creek Uranium Mine Permit Area	0.00	1,047.00
Reynolds Ranch ISL Uranium Mine Estimated Disturbance	37.06	9.04
Sub Total	47.61	1,475.79
Grand Total	868.76	1,653.02

4.8.2 Air Quality

Considering that there are no other “large-scale” projects proposed within the HFDPA or the airsheds immediately adjacent thereto, we would not anticipate a discernable increase in emissions from those already anticipated in conjunction with project-related activities - which are not expected to exceed either NAAWS or WAAQS standards.

In this regard, the cumulative impact of emissions resulting from the implementation of the Proposed Action would be much the same as those discussed for similar oil and gas projects in western Natrona County.

These impacts were discussed in the environmental documents prepared for the Cave Gulch-Bullfrog-Waltman Natural Gas Development Project (BLM 1997), the Cooper Reservoir Natural Gas Development Project (BLM 1998) and the Wallace Creek Extension 3D Vibroseis Project (BLM 2002), which all concluded that no significant impacts would occur to air quality or the air shed as a result of the activities proposed in conjunction with these respective projects.

In depth air quality analyses have also been conducted on three large-scale oil and gas exploration and development projects in southwest Wyoming including the Continental Divide/Wamsutter II Natural Gas Project EIS (BLM 1999b), Desolation Flats Natural Gas Field Development Project Final EIS (BLM 2004), and the Pinedale Anticline Oil and Gas Exploration and Development Project EIS (BLM 1999c). Analyses contained in the Continental Divide/Wamsutter II air quality study found that both short and long term predicted pollutant concentrations would comply with applicable air quality standards (i.e., WAAQS and NAAQS) resulting from direct, indirect, and cumulative project emissions (including construction and operation). Likewise, analyses presented in the Pinedale Anticline air quality study found no significant impacts to near-field air quality standards at a predicted 40 acre well density (16 wells per section). Air quality analyses conducted in conjunction with the Desolation Flats EIS found no significant adverse impacts to air quality resulting from either the Proposed Action (385 wells drilled with a 65% success rate) or from Alternative A (592 wells drilled with a 65% success rate). Clearly, the emissions from this 96 well exploration and development project would be inconsequential when compared to the level of development proposed in the Continental Divide, Desolation Flats and Pinedale Anticline projects and consequently would not violate applicable WAAQS and NAAQS air quality standards.

4.8.3 Cultural Resources

Those surface disturbing activities subject to federal jurisdiction proposed within the overall project area resulting from both the Proposed Action and any other activities proposed within the HFDPA would all be inventoried to determine their potential impact upon cultural resources. Any cultural sites identified in conjunction with these inventories would add to our cumulative understanding of past human habitation within the overall project area and any sites identified in conjunction with these surveys that were subsequently deemed to be potentially eligible for nomination to the National Register of Historic Places (NRHP) would either be avoided or the potential impacts thereto mitigated in accordance with BLM/SHPO recommendations.

Considering that any potentially eligible cultural sites identified within the overall HFDPA have been and would continue to be avoided, combined with the fact that no eligible cultural sites have been identified in conjunction with the Proposed Action to date, we would not anticipate any adverse cumulative impacts to cultural resources within the overall project area as a result of surface disturbing activities proposed therein.

4.8.4 Range Management

As stated in Sections 2.1 and 4.4.1, construction activities associated with the Proposed Action would result in approximately 821.15 acres of short term surface disturbance. Additional surface disturbance associated with the activities described in Section 4.1 would bring the short term total to 868.76 acres within the HFDPA or 1.89% of the overall project area. This short term disturbance is not representative of total existing surface disturbance within the HFDPA considering that much of the surface disturbance therein is pre-existing and therefore not included in the short term calculations. Under the disturbance assumptions presented above, the initial loss of approximately 868.76 (869) acres of vegetation would result in the short-term loss of approximately 263 AUMs for domestic livestock grazing in the HFDPA.

Long term surface disturbance within the overall project area upon addition of the disturbances quantified in Table 4.3 and following interim reclamation of the 869 acres referenced above would equal approximately 1,653.02 (1,653) acres or 3.59 % of the overall project area. This long term disturbance would result in the cumulative loss of approximately 501 AUMs. This long term loss of grazing equates to an overall decline of approximately 3.59% in available AUMs within the overall HFDPA. Considering that the majority of the overall project area consists of private (fee) surface estate, the loss of an additional 54 AUMs attributable to the Proposed Action over the long term would not represent an adverse cumulative impact.

In addition to the loss of grazing and concomitant AUMs, the disturbance of existing, native vegetation would create opportunities for the establishment of invasive, non-native (noxious) species. Invasive species are easily established and commonly found on all newly disturbed and reclaimed sites throughout Wyoming. These species are fast growing, can out-compete native species, can increase the danger of wildfires, and can prevent the establishment of native species including grasses, forbs and, and shrubs. Considering that invasive, non-native plant species would be controlled by SRC within the overall project area, it is unlikely that the Proposed Action would have any adverse cumulative impacts on native plant communities arising from the invasion of and replacement with non-native species. However, any area(s) within the overall project area subjected to new surface disturbance would represent an opportunity for the establishment of these invasive, non-native species.

4.8.5 Soils

As indicated above, surface disturbances associated with the Proposed Action would result in the short-term disturbance of approximately 821 acres of the soil resource within the Hornbuckle Field and would result in approximately 869 acres of cumulative short-term disturbance.

The addition of the projected 821 acres of new surface disturbance attributable to the Proposed Action would increase the cumulative short-term surface disturbance within the HFDPA area by a factor of 18.25 (1,825%). However, implementation of Best Management Practices (BMP) for reclamation and erosion control would result in a commensurate reduction in overall erosion rates as discussed in Section 4.5.1. The successful reclamation of surface disturbance resulting from the Proposed Action would only add a cumulative total of 177 acres to the 1,476 acres of existing long-term surface disturbance within the overall HFDPA - which does not represent major increase in long term disturbance within the project area.

Ultimately, some minor amount of soil would be expected to move off of disturbed areas within the HFDPA due to wind and water erosion; however, such movement would likely cease once the soils reach undisturbed areas. Cumulative impacts to soils would be negligible based on the use of BMP within the overall project area combined with routine monitoring of reclamation success and implementation of remedial measures as necessary to correct any identified deficiencies would reduce the cumulative impacts to the soil resource to negligible levels.

4.8.6 Water Resources

As indicated in Table 3.6, there are 46 existing water wells within the HFDPA including 4 wells permitted solely as domestic water wells, 40 permitted solely as stock water wells, and two wells permitted for both domestic and livestock watering purposes.

The greatest potential for degradation of the shallow Wasatch and Fort Union aquifers that supply these wells would be contamination resulting from activities within the HFDPA including the Proposed Action and the proposed uranium mining activities described in Section 4.8.1 proposed by Cameco Resources. Considering the precautions described in Chapter Two designed to protect the shallow fresh water aquifers (surface to 1,000 feet) during drilling operations, it is highly unlikely that contamination of these aquifers would contribute to a cumulative degradation of the overall near-surface water quality within the HFDPA. Likewise, mining companies engaged in ISL and surface uranium mining operations are subject to strict regulations regarding the degradation of ground water quality and are required to ensure that water quality within the mine permit area is returned to pre-mining conditions prior to decommissioning of the mine. Additional information on these requirements and the impacts of ISL uranium mining activities may be found in the Environmental Assessment of the Cameco Resources/Power Resources Incorporated Reynolds Ranch In-Situ Uranium Recovery Project (BLM 2010).

Additional oil/gas exploration and development activity within the HFDPA would result in negligible impacts to surface waters and the Cheyenne River watershed. In this regard, Table 4.3 presents a summary of the cumulative surface disturbance which would be expected within the Cheyenne River watershed and would include the surface disturbance associated with the construction, drilling, completion and production of the 48 additional wells proposed within the HFDPA. Implementation of the Proposed Action would increase the cumulative short term surface disturbance from in the immediate Cheyenne River watershed by approximately 822

acres (1,825%). Long term surface disturbance in the overall project area would increase by approximately 177 acres (12%).

As stated elsewhere in this document, surface disturbing activities associated with the Proposed Action would increase the cumulative long-term surface disturbance in the 46,080 (+/-) acre HFDPA by approximately 0.39 percent from 3.20.percent to 3.59 percent. An increase of less than 1 percent in overall surface disturbance within the HFDPA would be considered as a negligible impact upon the affected watershed. Moreover, as there are no permanent sources of surface water within the HFDPA, we do not anticipate any cumulative impacts to surface waters or the surface hydrology of the project area resulting from surface disturbing activities associated with the Proposed Action.

4.8.7 Wildlife

The 821 acres of short-term and 177 acres of long-term disturbance associated with the Proposed Action would add to the pre-existing surface disturbance within the HFDPA as discussed above. Overall, the generally small amounts of cumulative habitat loss would have minimal impacts on wildlife populations. Once the initial construction and drilling phases of the proposed project have been completed, the project area should return to a pre-project level of human disturbance. Moreover, once the wells in the HFDPA have been depleted, the subsequent abandonment and successful reclamation of existing facilities within the field would return the area to a pre-disturbance state.

Some small mammals could be killed during construction or by collisions with vehicles during production, and a small amount of wildlife habitat would be removed for the life of the project.

4.9 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible and irretrievable commitment of resources resulting from the Proposed Action would include any soils lost through wind and water erosion; the inadvertent or accidental destruction of previously unrecorded or potentially eligible cultural resources; the loss of animals due to earthmoving activities or by collisions with vehicles; and energy expended during project activities.

4.10 SHORT-TERM USE OF THE ENVIRONMENT VERSUS LONG-TERM PRODUCTIVITY

Short-term use of the environment during the life of the project would not detract from long-term productivity of the area. Even during the life of the project, only the small areas from which vegetation is removed would be unavailable for grazing and wildlife habitat. Once the project is completed and disturbed areas are reclaimed the same resources that were available prior to the project would be available again, except for the hydrocarbons that were extracted from the Sussex Fm. While it may ultimately take up to 25 years to regenerate a mature, climax stand of

vegetation (particularly shrubs such as sagebrush) comparable to those population(s) present prior to project implementation, successful and ongoing reclamation of surface disturbance within the overall project area would introduce vegetative communities which would support wildlife and livestock grazing, stabilize the soil, and reduce the potential for erosion and sedimentation.

5.0 CONSULTATION AND COORDINATION

5.1 BACKGROUND

The Hornbuckle Field Development Environmental Assessment was prepared by Anderson Environmental Consulting (AEC), an independent environmental consulting firm, with the guidance, participation and independent evaluation of the BLM. A list of the personnel responsible for document preparation, and their individual responsibilities are provided below.

5.2 LIST OF PREPARERS

Table 5.1 identifies the federal personnel associated with the review of this EA.

Table 5.1

Federal Interdisciplinary Team

Name	Office	Responsibility
Bureau of Land Management		
Jim Bauer	Casper Field Office	Physical Scientist
J. Bunderson	Casper Field Office	Civil Engineer
Brent Burgess	Casper Field Office	Range Management Specialist
Jude Carino	Casper Field Office	Archaeologist
Shane Evans	Casper Field Office	Hydrologist
Tom Foertsch	Casper Field Office	Geologist
Shane Gray	Casper Field Office	Wildlife Biologist
Matthew Halbert	Casper Field Office	Petroleum Engineer
David Korzilius	Casper Field Office	Natural Resource Specialist/Project Manager
Dustin Kravitz	Casper Field Office	Range Management Specialist
Kathleen Lacko	Casper Field Office	Planning & Environmental Coordinator
Patrick Moore	Casper Field Office	Asst. Field Office Manager - Lands & Minerals
Dora Ridenour	Casper Field Office	Archaeologist
Neal Ruebush	Casper Field Office	Realty Specialist
Randy Sorenson	Casper Field Office	Realty Specialist
Art Terry	Casper Field Office	Environmental Protection Specialist
Jennifer Yearout	Casper Field Office	Legal Instruments Examiner
David Chase	Reservoir Management Group	Supervisory Petroleum Engineer
U.S. Fish and Wildlife Service		
Pauline Schuette	Wyoming ES Field Office	Fish and Wildlife Biologist

Table 5.1 - Continued

Federal Interdisciplinary Team

Name	Office	Responsibility
U.S. Forest Service - Thunder Basin National Grassland		
Amy Ormseth	Douglas Ranger District	Minerals and Lands Program Manager
Department of Energy		
Scott Surovchak	Office of Legacy Management	Site Manager
Michael Widdop	S.M. Stoller Corporation	Project Manager ¹

1 S.M. Stoller Corporation is a contractor to the Department of Energy, Office of Legacy Management

Table 5.2 identifies those companies and associated personnel responsible for the preparation of the environmental assessment document.

Table 5.2

List of Independent EA Preparers

Name	Company Affiliation	Responsibility
Robert M. Anderson	Anderson Environmental Consulting	Project Manager, EA Preparation
Jeff Garrard	UELS, Inc.	Cartography - Maps
Mavis and John Greer	Greer Services	Cultural Resource Management
Steven A. Grosch	P.E. Grosch Construction	Cartography - Location Figures

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7.0 ABBREVIATIONS

AIRFA	American Indian Religious Freedom Act
AO	Authorized Officer
APD	Application for Permit to Drill
APE	Area of Potential Affect
ATV	All Terrain Vehicle
AUM	Animal Unit Month
BBS	Breeding Bird Survey
BLM	Bureau of Land Management
BMP	Best Management Practices
BO	Barrels of Oil
BOPD	Barrels of Oil per Day
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFO	Casper Field Office
COA	Condition of Approval
CRMP	Casper Resource Management Plan
DOE	Department of Energy
DR	Decision Record
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
E&P	Exploration and Production
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy Management Act
FONSI	Finding of No Significant Impact
FOOGRLA	Federal Onshore Oil and Gas Leasing Reform Act
FOOGRMA	Federal Onshore Oil and Gas Royalty Management Act
Fm	Formation
FR	Federal Register
HBP	Held by Production
HFDPA	Hornbuckle Field Development Project Area
H₂S	Hydrogen Sulfide
HWA	Hayden-Wing Associates
ISL	In-Situ Leaching
LOP	Life of Project
LACT	Lease Automatic Custody Transfer
MCF	Thousand Cubic Feet
MD	Measured Depth
MLA	Mineral Leasing Act
MSLE	Modified Soil Loss Equation
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act

NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTL	Notice to Lessees
NWI	National Wetlands Inventory
OBM	Oil Based Mud
PGW	Producing Gas Well
PIF	Partners in Flight
PLO	Public Land Office
POW	Producing Oil Well
PRB	Powder River Basin
PSD	Prevention of Significant Deterioration
RMP	Rocky Mountain Power
ROW	Right-of-Way
SARA	Superfund Amendments and Reauthorization Act
SGP	Shortgrass Prairie Habitat Type
SHPO	State Historic Preservation Officer
SLAMS	State and Local Air Monitoring Site
SMU	Soil Mapping Unit
SRC	Samson Resources Company
SS	Sagebrush Steppe Habitat Type
SUP	Multi-Point Surface Use and Operations Plan
SWPC	Southwestern Production Corporation
TDS	Total Dissolved Solids
T/E	Threatened or Endangered Species
UELS	Uintah Engineering & Land Surveying, Inc.
USDI	U.S. Department of the Interior
USC	United States Code
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VRM	Visual Resource Management
WAAQS	Wyoming Ambient Air Quality Standards
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WOGCC	Wyoming Oil and Gas Conservation Commission
WSEO	Wyoming State Engineer
WYNDD	Wyoming Natural Diversity Database

8.0 APPENDICES

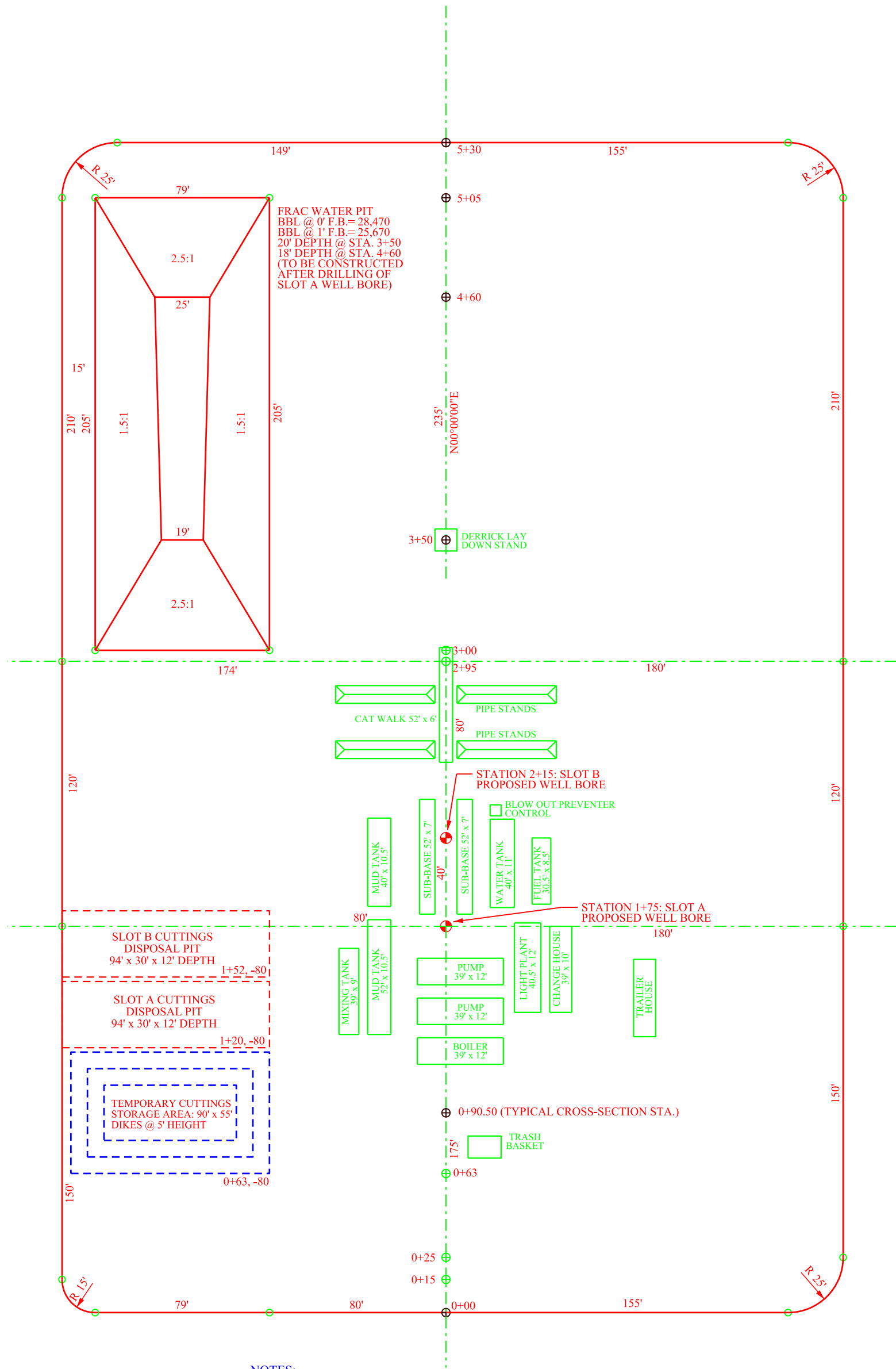
Appendix A: Typical Well Pad Layout

A typical well location showing the pad dimensions, dual well bores, temporary cuttings storage area, cuttings pit for Slot A and Slot B well bores, and the frac water pit.

Appendix B: Typical Production Facility Layout

A typical producing well location showing the placement of production facilities, reclaimed pits, truck turn-around, and areas of the pad that will be reclaimed (interim reclamation) following completion of both well bores.

This is a “typical” layout design and may vary on individual locations due to topography, the intersection of the access road with the well pad, and considerations involving the placement of the production facilities on cut (solid ground).



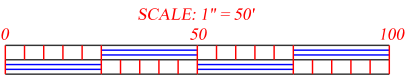
NOTES:

1. The drawing shows the conditions at the time that the second well, Slot B, is being drilled. The first well, Slot A, has been drilled and completed. Production equipment for that well is shown on Appendix B. Dependent upon drilling schedules, it may have been installed prior to the drilling of Slot B. It is possible that both wells will be drilled before any production equipment is installed.

2. The wells will be drilled with a semi-closed loop mud system. During the drilling of each well, the cuttings will be placed in the temporary cuttings storage area shown. This area will be constructed on the pad surface elevation with dikes of a 5-foot height. The interior of the area and the berm inslopes will be lined as per BLM requirements.

3. Immediately after completion of drilling of the proposed well, the cuttings will be removed from the temporary storage area and buried in the permanent storage area shown for that well. This area will be excavated with nearly vertical slopes to a 12-foot depth. A liner meeting BLM specifications will be installed in the excavation. The cuttings will then be placed in the excavation. The liner will be closed over the cuttings and covered with earth. This will be a short duration operation requiring perhaps one day of work.

PRJ. #:	68H10	SUR:		
REC:		DES:	SAG	8/08/11
DWG:	ea_ex2A-closed-drill	DWN:	SAG	8/08/11
PREPARED BY:				
P.E. GROSCH CONSTRUCTION, INC.				
SURVEYORS - ENGINEERS - CONSTRUCTORS				
P. O. BOX 36 WORLAND, WY 82401 (307)347-3332				



OWNER

**SAMSON RESOURCES
COMPANY**
DENVER, COLORADO

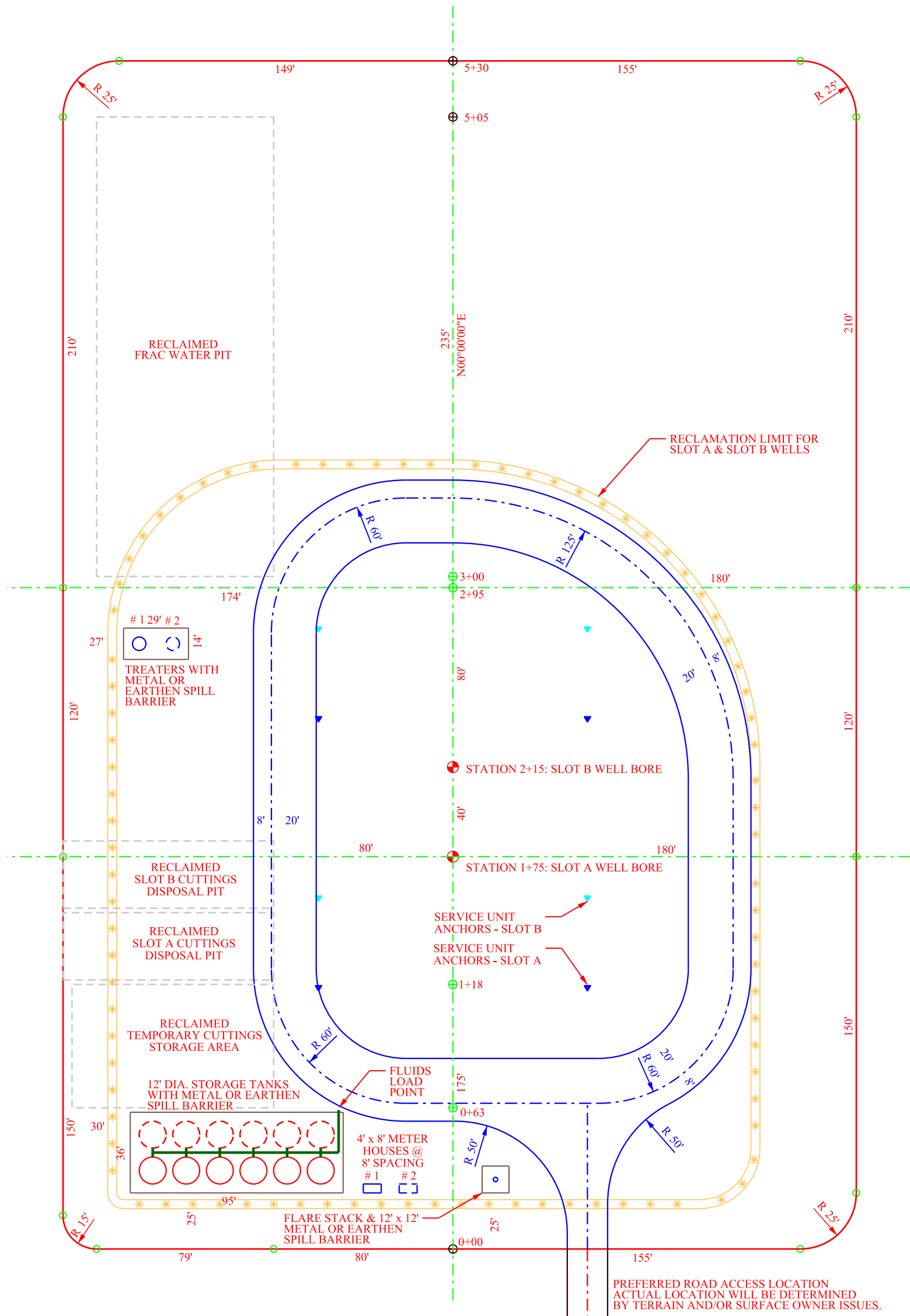
PROJECT

**TYPICAL WELL SITE
FOR DRILLING OPERATION**
HORNBUCKLE FIELD
CONVERSE COUNTY, WYOMING

DRAWING TITLE

APPENDIX A
DRAWING DESCRIPTION

**TYPICAL WELL
SITE LAYOUT**

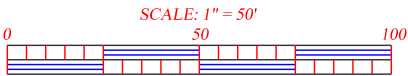


NOTES:

1. The drawing shows the proposed location of production equipment and the proposed fluids haul loop route.
2. The storage tanks and treaters will usually be placed near the positions shown. Dependent upon the access road location, it may be necessary to locate the flare stack and meter house in different positions. In any case, the minimum safety spacing of 125 feet will be observed.
3. The preferred position of the well service anchors is at the corners of a 120 foot square, centered on each well bore. This results in a radial distance of approximately 85 feet from the well bore to the anchor.
4. The interim reclamation limit is estimated to lie outside the anchors as shown to allow the movement of equipment outside the anchors when a well service unit rig is erected over the slot A or slot B well bore. The limits are shown to lie approximately 8 feet outside the proposed facilities.
5. The area of the pad within the pad perimeter is 4.30 acres prior to interim reclamation. The area of the pad within the proposed interim reclamation boundary for the wells at slot A and slot B is 2.05 acres. Thus approximately 47.7 % of the area of original pad will be used for production operations.

PRODUCED FLUIDS HAUL LOOP ROUTE NOTE:
The haul route center line is proposed as shown. The shoulders of the route are shown to illustrate the validity of this route. The nominal width is 16', with 8' on each side of center line. Curve widening on the inside of curves is shown where the widening is 12' for a radius of 60'. Although a curve widening of 4' for a radius of 125' is sufficient, a value of 12' is used to simplify construction. This configuration will support a tractor-trailer-pup combination hauling unit. The entry point to the haul loop would be determined by the actual entry point of the road. The radius of the approach to the haul loop should be a minimum of 50 feet as shown in this example.

PRJ. #:	68H10	SUR:		
REC:		DES:	SAG	8/08/11
DWG:	ea_ex2B-closed-prod	DWN:	SAG	8/08/11
PREPARED BY: P.E. GROSCH CONSTRUCTION, INC. SURVEYORS - ENGINEERS - CONSTRUCTORS P. O. BOX 36 WORLAND, WY 82401 (307)347-3332				



OWNER
**SAMSON RESOURCES
COMPANY
DENVER, COLORADO**

PROJECT
**TYPICAL WELL SITE
FOR PRODUCTION ACTIVITIES
HORNBUCKLE FIELD
CONVERSE COUNTY, WYOMING**

DRAWING TITLE
APPENDIX B
DRAWING DESCRIPTION
**TYPICAL PRODUCTION
FACILITY LAYOUT**



Environmental & Regulatory Services